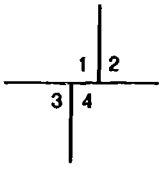
Sourcebook of Science Education Research in the Caribbean



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Sourcebook of Science Education Research in the Caribbean

Pamela Fraser-Abder
Faculty of Education
University of the West Indies
St Augustine, Trinidad

Division of Science
Technical and Environmental
Education

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PREFACE

This document has been prepared within the framework of Unesco's programme in the teaching of science and technology. It is the second bibliographic guide that has been prepared in this Series - the previous document of this type being nº 18 on the topic of "The Social Relevance of Science and Technology Education".

This "Sourcebook of Science Education Research in the Caribbean" provides a comprehensive annotated listing of research in science education and related fields undertaken over the period 1970-1987, with a few references to relevant earlier works. It is designed to guide and assist science education researchers in their task of identifying published and unpublished research relevant to their area of interest. The guide may also be helpful to those concerned with curriculum development in science education.

The selection of material and the opinions expressed are those of the author; they are not necessarily those of Unesco.

FOREWORD

That science and technology are important factors in development is no longer questioned. The actual process, and the precise mix of factors, involved in the science + technology = development equation are still matters of uncertainty, and the debate is now on whether there is really any causal relationship between science and technology. Sacrilegious utterances like those of the political scientist Michael Jackson - "to emphasise science as the solution to problems of public policy is to diagnose scarcity as cause and to prognosticate wealth as cure" - are almost becoming commonplace. Robin Clarke is perhaps not the only one who feels there is an urgent need to answer the question, "is science a cultural luxury or a social necessity?"

Despite this wave of new thinking, prompted mainly and not without some justification by social scientists, countries continue to put their faith in the transforming power of science and technology, and they have the evidence of their senses to support them. What emphasis should be given to science, what to technology, and when, in a country's evolution are questions that elicit no simple answers, but there is overall agreement globally that science education in schools is the bedrock for effective impact of science and technology on development. The Education Working Party of the Foundation for Science in Britain most recently recommended the implementation of a balanced science education for <u>all</u> pupils up to the age of 16, and the firm integration of the concepts and applications of technology with science education throughout the years of compulsory schooling. Instructively, the Working Party stressed that "science education should draw extensively on the everyday experience of pupils, and should be aimed at preparing pupils as effectively as possible for adult and working life." In the United States scientists in particular, alarmed by the rapidity with which the Japanese are closing the technological gap, and relating this to that country's tremendous investment in pure science, are urging far greater attention to the compass and quality of science education.

It is scarcely to be wondered that Caribbean countries are also voicing concern about the expansion and improvement of science education in the schools. Their concern poses a great challenge to science educators, and more especially to researchers in science education. For it is to the latter that one must ultimately turn to for solutions to some of the recurring problems that have bedevilled the teaching of science in the Caribbean. How to make science interesting and relevant, how to improve the quality of science teaching, how to raise the level of scientific literacy, are not issues that are unique to the Caribbean. But this is poor consolation for countries starting from a relatively low scientific base. For these countries, finding the answers are more critical and more urgent. More research, not less is the order of the day.

This is why this sourcebook of science education research in the Caribbean is so useful and timely. According to Dr. Fraser-Abder the work is "designed to guide and assist science education researchers in the task of identifying published and unpublished research relevant to their area of interest". It is the beginning of the process of stimulating further research in a relatively neglected field of paramount importance, for we are told that there is more to come. "No attempt has been made" the author observes, "to do a meta-analysis of the research or to make recommendations for further research; this is the theme of another project which is now in progress". We await this further development, but even at this stage we must be profoundly grateful that Dr. Fraser-Abder has had the vision and interest, not to mention the dogged persistence, to produce a work of inestimable value to the cause of science education research in and for the Caribbean.

This is a comprehensive study. The abstracts cover research undertaken in some eleven areas, and many of the papers have direct relevance for practising teachers, as well as for the examination system. The significance of this work thus extends beyond the supply of information to the researcher, and one hopes that it will attract the attention of the wider audience, for whom it may not have been intended but who clearly has much to benefit from it.

For someone who has been advocating a greater injection of the technological dimension in science education in the Caribbean, I was struck by the paucity of research addressing this very important issue. But this simply reinforces my observation about the value of Dr. Fraser-Abder's work. In it the strengths and weaknesses of the science education research system are readily identified. We at least know where we are. Now perhaps we can begin with greater confidence to plan and work towards where we ought to be.

Dennis Irvine
Subregional Advisor in Science
and Technology
UNESCO

ACKNOWLEDGEMENTS

This sourcebook was compiled during the period 1985 - 1987 at The University of the West Indies, St. Augustine. I wish to thank The University of the West Indies Research and Publication Fund Committee and United Nations Educational, Scientific, & Cultural Organisation for funding the project. Without their funding the work would not have been possible.

I have greatly valued the assistance and support given by fellow science education researchers in the islands, in particular, Dr. Joyce Glasgow, who responded to my request for abstracts for the First Consultation on Science Education Research in Latin America and the Caribbean, held in Trinidad in 1986, by producing a document on Science Education Research in Jamaica, which I have reproduced, with Dr. Glasgow's permission, in the Appendix to this book.

I would also like to thank Dr. Marlene Hamilton, Ms. Shirley Evelyn and Ms. Karen Lequay for much help in locating references; my research assistants, Ms. Michelle Jodhan for bibliographic searches and Ms. Catherine Shepherd for bibliographic searches, abstracting and proofreading; Ms. Audrey Chambers at UNECLAC for assistance in data base searches; Ms. Liesl Sankeralli for assistance in collating the book, officials at the Ministeries of Education in the islands, and the CARICOM Statistical Section for information on the status of science education and statistical details. Thanks also to my colleagues in the Caribbean who generously supplied information by filling out questionnaires, submitting abstracts and responding to questions on the telephone.

A special thanks is offered to Ms. Yolande Dash who spent countless hours typing the book, Ms. Jeanette Morris for translating the Spanish abstracts and Dr. L.D. Carrington for French translations. Sincere thanks to Ms. Sharon Laurent of CARIRI for her assistance in locating references, reading the first draft and helping to make, this book a reality. Last but certainly not least, I want to thank my family for their assistance, understanding and tolerance during the period I spent writing this book.

Whatever merits this publication proves to have, owe much to the contributions made by these colleagues. I take full responsibility for the inevitable weaknesses and deficiencies in the book.

INTRODUCTION

This sourcebook of Science Education Research in the Caribbean has been in gestation for several years. My literature review and contact with persons engaged in science education research in the Caribbean over the past ten years have revealed that for developing countries a relatively large amount of research in science education has been done. Unfortunately much of this has not been published in international or regional journals. Many dissertations remain in the foreign universities where they were written and rarely benefit the population that formed the sample for the study. The research findings remain relatively inaccessible to science education researchers in the Caribbean.

There is also a lack of communication between research personnel in the various islands. Research linkages tend to be formed with foreign researchers, who publish in international publications. The regional researcher who is working on a parallel topic remains unknown. There continues to be an increasing amount of science education research on the Caribbean both within and outside the region, which goes unknown because of the absence of an organized framework for reporting, publishing or housing these research findings.

In this setting, the need for a sourcebook on science education research which would highlight research which has been completed, which is in progress or planned, the personnel engaged in such research, the science curricula used and some statistical information on the various islands, was obvious. Currently, there is no book which has attempted to gather this information.

This book presents:

a) abstracts of published and unpublished completed research;

b) research in progress or planned;

c) personnel engaged in such research;

d) a list of journals in which research has been published;

e) conferences which have been held in the region, their aims and objectives; and

f) the science teachers' associations, science curricula and school population statistics of the islands (where available).

To ensure as full a coverage as possible, methods of data collection included the following:-

1. Letters to science education researchers who had indicated an interest in attending the first Regional Consultation on Science Education Research in Latin America and the Caribbean. The letters requested these researchers to prepare abstracts of science education research done in or about their country. Only one complied - Dr. J. Glasgow who did a bibliography on Science Education Research in Jamaica, reproduced here as an Appendix.

2. Letters to Ministries of Education, research organisations and University of the West Indies personnel requesting information on the status of science education research in their country. In many countries research was either non-existent or had a low priority. Research tended to be done for post-graduate degrees and by some members of the Faculty of Education, at the University of the West Indies.

3. Searches of bibliographies, indexes and databases. These yielded mainly work done in foreign universities, published in foreign journals or presented at international conferences.

4. Search of international and regional journals.

5. Letters to science education researchers in the Caribbean requesting abstracts of their theses and/or other publications.

6. Personal contacts with personnel in the islands.

7. Letters to science education researchers in foreign universities, requesting information on research done in and about the Caribbean.

A guide to the annotated bibliography.

The bibliography lists references to published and unpublished research on science education in the Caribbean between 1970-1987, with a few references to relevant earlier works. The material listed includes doctoral and masters theses, journal articles, books, conference/seminar papers and unpublished papers.

The material has been classified according to the following themes:

1. Agriculture education
2. Assessment in science education
3. Cognitive development/concept attainment

4. Curriculum development/implementation/evaluation
5. Environmental education
6. Science achievement/orientation
7. Science attitudes
8. Nutrition/health education
9. Science education/teaching
10. Science teacher education
11. Scientific literacy

These subjective groupings have been suggested by the main content of the studies as several papers may fall under more than one theme.

Within each section, references are listed alphabetically by author. Several works by the same author are further classified by publication date and/or alphabetically by title. Each entry comprises the bibliographic description, abstract and an alphanumeric code. This code consists of a two-letter country code, the key to which is given in the country index, and a four-digit reference number. The first digit refers to the chapter in which the entry appears, the other three, to its order of appearance.

The exception to the above are works pertaining to Jamaica. These have been listed in the main bibliography but the abstracts appear in the Appendix. The second reference number for most of the Jamaican entries, refers to its location in the Appendix.

In some cases, abstracts could not be located and only the bibliographic description is given. Despite efforts made to incorporate all relevant information which has come to my attention and to verify each entry, errors and omissions may still exist.

This work is designed to guide and assist science education researchers in the task of identifying published and unpublished research relevant to their area of interest. If it guides, assists and lends direction to their research pursuits it will have achieved its purpose. No attempt has been made to do a meta-analysis of the research or to make recommendations for further research, this is the theme of another project which in now in progress.

It is my hope that the information in this book will lead to research networking among Caribbean science education researchers and ultimately the formation of a Caribbean Consortium for Science Education Research.

It is planned to update the sourcebook periodically to incorporate any corrections and additional information. Please address your comments, suggestions and abstracts to:

Dr. Pamela Fraser-Abder
Department of Educational Research
and Development
Faculty of Education
The University of the West Indies
St. Augustine
Trinidad, West Indies.

PART I

AN ANNOTATED BIBLIOGRAPHY OF SCIENCE EDUCATION RESEARCH IN THE CARIBBEAN.

AGRICULTURAL EDUCATION

Research in Agricultural Education can be subdivided into the following sections:-

1) Agricultural education programmes in primary and secondary schools: facilities, teacher training, methodology, student ability and attitude, readability of textbooks, assessment of the curriculum and its effectiveness and examples of successful programmes.

2) Agricultural education programmes at post-secondary level: curriculum development, assessment of the role and impact of these programmes on the community, and strategies for co-operation between teaching institutions.

AGARD, A.L., Jr. (1977) GY 1001

An analysis of selected aspects of the agricultural education program in Guyana with implications for program development. Unpublished Ph.D. dissertation, Louisiana State University and Agricultural and Mechanical College, U.S.A.

Sixty-eight teachers of agriculture and 563 students enrolled in agriculture programmes were surveyed. Among the findings of the study are: the majority of agriculture teachers were trained in primary education; teachers felt that their training in instructional methods was poor; agricultural education was generally compulsory for all students in all forms; problems faced included teacher shortages, lack of finances and the unavailability of equipment; students were reluctant to take up farming as a career; students felt that the programme should be optional as they got older.

ANDERSON, D.C. (1983) CR 1002

Overview and analysis of agricultural programs in higher education in Costa Rica. Unpublished Ph.D. dissertation, Iowa State University, U.S.A.

Four public institutions offer fifteen basic career programmes in agriculture and of these the Agronomy Faculty of the University of Costa Rica is by far the most prominent. A survey of 71 graduates of the Faculty over the period 1979-1981 reveals a general concern for more practical or field-related experience and the view that thesis research was not put to beneficial use. Graduates were predominantly employed

by the government, in the areas of research, programme execution, personnel supervision, programme planning and extension.

BOBBITT, F. (1987) XI 1003

A comparison of the development of agricultural education in the Caribbean as compared to other developing countries. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

The paper discusses the strengths that exists in Caribbean agricultural education: the training of teachers, the development of appropriate agricultural education programmes and the training of employable graduates. The improvement in the curriculum, teaching techniques and facilities that prepare an individual for employment in agriculture are areas that continue to need further development. Employment in agriculture is dependent upon the type of education received, the opportunities that exist and the attitudes of students and parents toward agriculture. The production sector has to be viable and attractive if the system is to work effectively.

BROWN, G. (1987) TT 1004

Assessment of the impact of research and extension programmes at the farmer level and on the agricultural sector. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

The paper argues that the impact of research and extension is dependent on the removal of barriers such as inappropriate policies, institutions and infrastructure, and the restoration of regional confidence and financing of indigenous research and extension.

DOUGLASS, S. (1983) TT 1005

A plan for teaching agriculture at the upper secondary level in Trinidad and Tobago. Unpublished M.Sc. dissertation, Michigan State University, U.S.A.

In keeping with its policy to finance educational projects in developing countries, the World Bank has provided a loan to the government of Trinidad and Tobago to develop a training college for teachers of agricultural science in secondary schools. This study investigates the agricultural education systems of Trinidad and Tobago, Botswana, Taiwan, India and Israel, and examines the views of agricultural educators on how the subject should be taught. It recommends that students be provided with skills and knowledge needed to pursue agriculture as a vocation and/or

continue further study at higher levels. Sample projects and lessons are described.

GOMES, P.I. (1987) XI 1006
The role of agricultural education in accelerating development and technological change in caribbean agriculture. Paper presented at the Conference on the Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

Several institutions in the Commonwealth Caribbean are involved in agricultural education, at the national and regional levels through the primary school system, up to the secondary and tertiary levels. However, the overall impact and net effect of these institutions on agricultural development in the region seems to have been less than was desired. Constraints and impediments are clearly identifiable in the wider economic, social and political conditions affecting the development of Caribbean societies. Questions can be raised on the roles attributed to educational institutions, the resources and organisational structures, the underlying philosophy and orientation that guide how they function as parts of the process of agricultural development. The paper takes a critical look at these issues and argues for the need to maximise resources through linkages and collaboration, provided that an adequate framework and national goals have been defined in support of agricultural development.

GUMBS, F. (1987) XI 1007

Strategies to enhance collaboration among the various agricultural institutions in the Caribbean and to increase the linkages between research and extension. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

The paper recognises that in the English-speaking Caribbean there are several tertiary level agricultural training institutions and a not insignificant research capability, but that the history and insularity of territories have prevented the optimum utilisation of these capabilities. The paper outlines the role that the Faculty of Agriculture, UWI could play in curriculum development, standardisation of programmes, and co-ordination of agricultural training in the region, to facilitate accreditation and horizontal and vertical movement between institutions. A system to reduce costs of training for non-resident candidates is discussed.

HENDERSON, T.H. (1987) XI 1008

Agricultural education and training for integrated rural development. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

> In the Caribbean, agricultural education and training for rural development is provided at three levels - university, agricultural schools or institutes and local agricultural department in-service training programmes. Methodological requirements for the provision of pertinent agricultural education and training for integrated rural development are discussed, and some constraints and opportunities for providing this at each of the three levels are examined.

JENNINGS, Z.D. (1986) BZ 1009

Belize's Rural Education Agriculture Programme: some factors that have contributed to its success. Paper presented at Conference on Vocationalising Education, University of London, Institute of Education, 7-9 May.

MARAJ, L. (1986) TT 1010

Farm Economics can come Alive. Unpublished Dip. Agric. Ed. Research Paper. Eastern Caribbean Institute of Agriculture and Forestry, Agricultural Teachers Education Centre, Trinidad.

> This study compares the teaching of budgeting, decision making and farm recording using the Project Method and the Expository Method in two schools. In each school, one class used the more traditional expository method of teaching while the other class was assigned a project. The project could only be successfully completed if actual budgets were made, decisions taken and accurate financial and physical records kept by the students. The results showed that in one school there was a significant difference in favour of the Project Method, in the other school there was no significant difference between the two methods.

MEADERS, O.D. (1965) XI 1011

Developing and strengthening agricultural education in the Eastern Caribbean: reports on Antigua, Dominica, Grenada, St. Lucia [and] St. Vincent. St. Augustine, Trinidad: Caribbean Agricultural Extension Project.

> Consists of five reports based on fieldwork in each country. The objective of the study was to assess the training opportunities available for agricultural extension officers and ways of strengthening linkages between agricultural extension and agricultural education. In each country visited discussions were held with key officials and the relevant literature was reviewed. The study concludes that

there is a need to strengthen the agricultural education programme in all the countries visited and recommendations are made to the Ministry of Agriculture and Ministry of Education.

MILLAN-SAMBOLIN, J.A. (1972) PR 1012

Professional and technical competencies needed in the pre-service vocational agriculture curriculum in Puerto Rico. Unpublished Ph.D. dissertation, Louisiana State University and Agricultural and Mechanical College, U.S.A.

To determine technical and professional training needs of prospective vocational agriculture teachers, questionnaires providing for the evaluation of the undergraduate teacher education curriculum at the University of Puerto Rico, and the evaluation of 143 technical and professional competencies, were distributed to vocational agriculture teachers, supervisors and teacher educators. Most respondents favoured a revision of the undergraduate teacher education curriculum. The teachers' greatest training needs were in the areas of farm mechanics, farm business management and professional education.

MOONSIE-SHAGEER, S. (1986) TT 1013

An investigation into the readability of the agricultural science textbook used by form one junior secondary school students in Trinidad. Unpublished Dip. Agric. Ed. research paper, Eastern Caribbean Institute of Agriculture and Forestry, Agricultural Teacher Education Centre, Trinidad.

To determine reading levels of students, an Informal Reading Inventory (IRI) was administered to a randomly selected sample of twenty students from two junior secondary schools in North Trinidad. Three passages were randomly selected from the textbook, Agricultural Science for the Caribbean, Book 1, and readability was determined using Fry's readability graph. The text was also evaluated for sexism, coherence, audience appropriateness, and graphics. The findings indicate that 50 per cent of the sample operate at the frustration level of reading for their age. This is compounded by a text which is way above the reading levels of the students and discriminates against females. Recommendations are made for improving the text, improving teaching and for the introduction of a reading programme in the schools.

POONAI, N. (1978) GY 1014

A proposed curriculum in extension education for in-service training of agriculture field assistants in Guyana. Unpublished Ed.D. dissertation, Louisiana State University and Agricultural and Mechanical College, U.S.A.

The proposed curriculum was developed in accordance with the Tyler rationale for curriculum development and has five teaching objectives. Among these are to enable field assistants to apply concepts in extension education and related social sciences to develop and implement an extension programme; develop and use a work plan and teaching plan; and evaluate extension programmes. If implemented at the Guyana School of Agriculture, that institution would need to modify its existing programmes to make them more diverse and more continuous.

RAJKUMAR-WHITE, G.A. (1986) TT 1015

A study to determine if students have the necessary ability to perform at the knowledge level required by the CXC agricultural science syllabus. Unpublished Dip. Agric. Ed. research paper. Eastern Caribbean Institute of Agriculture and Forestry, Agriculture Teacher Education Centre, Trinidad.

The Science Reasoning Task (SRT) VI - chemical combinations, was administered to one, fifth form class in four senior comprehensive schools in South Trinidad, to determine the cognitive level of the students in the sample. Results indicate that ability levels of the students range from low concrete to high formal with most students in the transitional stage between concrete and formal. The objectives of the CXC Agricultural Science Syllabus require abstract and scientific thinking, suggesting a mismatch between student ability and syllabus objectives.

RAMPERSAD, S.A. (1980) TT 1016

Agricultural science in primary schools. Social Studies Education, 17, (October), 18-23.

The article highlights unfair practices in primary school agricultural competitions such as the employment of professional gardener by schools, the appearance and disappearance of plants prior to and after judging and the allocation of funds in excess of the amount alloted, to achieve a winning garden. Recommends, inter-alia, that the School Garden Competition as it is run at present, should be abandoned in favour of an awards system; that pupils should be encouraged to do gardening at home, with materials supplied freely or at a nominal cost; and that a specialist agriculture science teacher should be attached to every school.

SAMPSON-OVID, L. (1985) TT 1017

Assessment of agricultural education in the school system of Trinidad and Tobago. Unpublished M.Sc. (Agri. Ed.) research paper, University of California - Davis, U.S.A.

This study examines several questions which need to be

addressed by the agricultural education sector: (a) Is the agricultural science curriculum addressing the needs of the country as stated in agricultural policy? (b) Does the current curriculum in agriculture prepare students for employment in the agricultural industry? (c) Is there employment in agro-industry for students of agriculture? (d) Is the current curriculum in agriculture compatible with the economic, political, social and employment trends in the country? (e) What curricular changes need to be made to ensure compatibility with the above trends? A non-experimental design was utilized in this study, and a descriptive report presented. Several recommendations are proposed amongst which are a reorganisation of the agricultural science curriculum and an expansion of its scope; a revision of the curriculum at teacher training colleges continuing training programmes and in-service guidance for teachers of agriculture.

SMITH, W.M. (1982) JM 1018
A study to develop a model curriculum in agricultural education for secondary schools in Jamaica. Unpublished Ph.D. dissertation, Cornell University, U.S.A.

A model curriculum in agricultural education is developed for secondary schools in Jamaica, using data collected from selected Jamaicans and appropriate documents. Questionnaires were distributed to 298 educators and agricultural extension personnel to determine their perceptions regarding the kind of agricultural education programme that would be suited for Jamaica. Among the findings were the need to develop a programme to meet national goals for increasing food production and improving the standard of living of rural people and the need to awaken and guide students toward agricultural careers and becoming agriculturally informed citizens.

TAYLOR, O. (1987) TT 1019

Reflections on university level training. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

Describes and examines the university experience of graduate and undergraduate agriculture students. Concludes that while the experience is beneficial it is not satisfying. A lot more needs to be done so as to encourage an atmosphere in which creativity and independent thought abound.

TIMOTHY, E.E. (1987) XI 1020

The nature of curriculum, environment and facilities required in agricultural education and training. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

> This paper discusses the present inadequacies in the agriculture curriculum and teaching facilities, the socio-cultural environment within which agricultural education proceeds in the Caribbean and the significance of training to the agricultural development of the region. Some suggestions for improvement are provided.

VILLAMIL, F.J.A. (1979) PR 1021

The comparative effectiveness of two different methods of teaching technical farm credit and total money management to tenth grade vocational agriculture students and adult farmers in Puerto Rico. Unpublished Ph.D. dissertation, University of Connecticut, U.S.A.

> Three hundred vocational agriculture students, equally divided between tenth grade students and adult farmers, were divided into a lecture-discussion group and a modular instruction group. Both groups were pre-tested using the achievement test "Farm Credit and Total Money Management", instructed for fifteen hours over a three week period, post-tested and re-tested, and the differences in scores were treated statistically. Among the findings were: no significant difference in achievement of knowledge between the two groups; retention of knowledge was significantly greater for the modular instruction group; and adult farmers scored higher than tenth grade students at the post-test and re-test regardless of teaching method.

WHITE-PRICE, H.J.E. (1986) TT 1022

A study of the attitudes of the agricultural science students of the Barrackpore Senior Comprehensive School to the subject in relation to their parents' involvement in production agriculture. Unpublished Dip. Agric. Ed. research paper, Eastern Caribbean Institute of Agriculture and Forestry, Agriculture Teacher Education Centre, Trinidad.

> A Likert-type inventory was administered to a sample of 70 fourth and fifth form agricultural science students ranging in age from 14 to 16 years. Seventy five per cent of the sample displayed positive attitudes, their parents were involved in production agriculture. However, students showed little or no inclination towards pursuing agricultural occupations on leaving school and their occupational aspirations were influenced by their parents.

WILLIAMS, D.C. (1979) JM 1023

Agricultural education through non-formal programs - Jamaica. Agricultural Education Magazine, 52 (July) 10.

WILSON, L.A. (1987) XI 1024

Alternative framework and human resources for agricultural training and development in the Caribbean. Paper presented at the Conference on The Socio-Economic Impact of Agricultural Education in the Caribbean, Port-of-Spain, Trinidad, June 22-25.

Shortcomings in the Caribbean agricultural institutional system with particular reference to the training component of the system established since 1948, are identified and an alternative framework and human resources for agricultural training and development are outlined.

ASSESSMENT IN SCIENCE EDUCATION

Research in this area falls under the following categories:

1. Adequacy of the G.C.E. Biology examination;
2. CXC and assessment;
3. Problems of assessing accuracy in measurement;
4. Pre-school assessment in mathematics;
5. Mathematical abilities of secondary students;
6. Development, validation and administration of science and mathematics tests;
7. Assessment of projects and practical work.

BEAUMONT, S.O. (1962) JM 2001

Determining the adequacy of the Cambridge school certificate examinations in evaluating the attainment of biology teaching objectives in Jamaican schools. Unpublished Ph.D. dissertation, New York University, U.S.A.

BRATHWAITE, W.E. (1979) XI 2002

CXC and science: some issues about Basic and General proficiency. Caribbean Journal of Science Education, 1, (April), 26-28.

Discusses the definitions of Basic and General Proficiency in the Caribbean Examinations Council Secondary Education Certificate fact sheet and attempts to assess their implications for science programmes currently being developed by CXC. Views the Integrated Science (General) syllabus coverage as aiming more at finding the maximum load students can carry, than the minimum factual base needed to support the major concepts in science. Other issues raised are the need to indicate the percentage of the ability range to be accommodated by Basic; specification of teaching hours needed to complete the syllabus; and the possibility of overlap in examination papers.

BRATHWAITE, W.E. (1986) XI 2003

Evaluation of practical work in science - accuracy in measurement. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 191-199. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Analyses the problem of assessing accuracy in measurement using data from class experiments on the reaction rate of thio-sulphate with hydrochloric acid. Considers the strengths and weaknesses of graphs as evidence of measurement ability and the implications for assessment. The merits of computed linear regression are discussed. Concludes that while its routine use would neither be feasible nor necessary in schools, an appropriate calculator would be adequate for occasional use in a class.

BROOMES, D.R. and CHARLES, D. (1976) GY 2004

Manual for pre-school assessment in modern mathematics. Cave Hill, Barbados: School of Education, University of the West Indies.

To ascertain the nature of mathematical concepts held by pre-school children in Guyana, the School Assessment in Mathematics was constructed and administered to about 1200 children entering Grade 1. The data obtained were used to produce the present version. The test is designed to measure the mathematical achievement of children in seven topics: numbers and operations, measurement, geometry, functions and graphs, sets, logic and applications.

COLE, S.E. (1970) PR 2005

An assessment of mathematical abilities of secondary students in selected schools of Puerto Rico. Unpublished Ph.D. dissertation, University of Nebraska, Lincoln, U.S.A.

Spanish version of the test batteries of the Y series of the National Longitudinal Study of Mathematical Abilities (NLSMA) were administered to 7,600 students in 38 junior and senior high schools in Puerto Rico. Areas of relative strength or weakness as compared to the U.S. test results were noted. Operations with integers, order of property of rational numbers and solution of linear equations given one unknown, were some areas of strength; areas of weakness included finding averages and ratio and proportion. With respect to regional and type of school comparisons, most of the significant differences can be accounted for by differences in mental ability. The study also shows that the non-mathematical sections of the NLSMA tests are ineffective as predictors of mathematical achievement.

ERNEST, P. (1984) XI 2006

The CXC mathematics examination: a Caribbean innovation in assessment. Educational Studies in Mathematics, 15, (November), 397-412.

Describes three innovatory aspects of this examination: the certificate awarded shows profile grades for ability in computation, comprehension and reasoning as well as the overall grade; pupils may sit the examination at the level of Basic or of General Proficiency; and the curriculum is presented in the manner of a curriculum guide in a deliberate attempt to influence the teaching of the subject.

ESQUIVEL, J.M. and QUESADA YANNAARELLA, L. (1986) CR 2007

The development, validation and administration of a criterion-referenced science battery for general education students in Costa Rica. Paper presented at the 58th National Association for Research in Science Teaching Conference, French Lick Springs, Indiana, U.S.A. April 15-18, 1985.

Sets of 16 to 20 behavioural objectives were specified in order to define the content domain to be measured by each test. At least 10 items were constructed to match each objective from which 3 were chosen by a panel of 5 science educators. The fourth-grade test was composed of 43 items, the sixth-grade test of 42 items and the seventh and tenth-grade test of 60 items. The tests were administered to 1012 tenth-graders, 1130 sixth-graders, 794 seventh-graders and 449 tenth-graders, enrolled in elementary and high schools in Costa Rica. Only two objectives were mastered by fourth-graders in a specific region and all other objectives were mastered at all other grade levels. Norm-referenced analysis of the data using ANOVA showed significant differences among regions and type of elementary and high schools.

ESQUIVEL, J.M. (1986) CR 2008

The development, validation and administration of a test of science process skills to Costa Rican school students. Paper presented at the 59th Annual Conference of the National Association for Research in Science Teaching, San Francisco, California, U.S.A., March 28-31.

To develop a Spanish test on science process skills, criteria were outlined and objectives were written for each process skill. Items were developed to match these objectives and judged by a panel of 10 science educators. The third and final version of the test was then administered to samples of 503 seventh, 400 tenth and 520 eleventh graders. Results reflect a very poor achievement in science process skills.

FREYTES, F. (1973) PR 2009

The development of a criterion-referenced test of mathematics. Charleston: West Virginia State Department of Education.

A joint project of the Puerto Rican Division of Evaluation and the Mathematics Program in the Department of Education, the approach used included: clarification of objectives; development of test items for each objective; development of test items to measure related objectives, and providing a score and score interpretation for each objective.

JOHNSON, D.E. (1982) JM 2010/906

The development of a diagnostic test in mathematics for third graders. Paper presented at a Research Conference, Ministry of Education, Jamaica, February 2-5.

KING, W.K. (1977) XI 2011

Feedback and assessment. Report of the first Biennial Eastern Caribbean Standing Conference on Teacher Education, pp 116-123. Edited by R.M. Nicholson. Cave Hill, Barbados: School of Education, University of the West Indies.

Assessment - the process of investigating the status of an individual or group using objectives as reference points - must contain five built-in factors considered important by most evaluators: continuity, consistency, comprehensiveness, objectivity and validity. The main purposes for educational assessment are to measure learning ability, compare pupils, measure progress, diagnose difficulties, compare schools and in research. The strengths and weaknesses of three techniques of assessment (essays, structured questions, practical and project work) are briefly discussed.

LAMBERT, E.N. (1979) XI 2012

Integrated science to O-Level - a Caribbean case study. Science education for progress: A Caribbean perspective, pp 46-51. Edited by C. Lancaster and W. King. London:International Council of Associations for Science Education.

Briefly considers some strengths and weaknesses of the Caribbean Examinations Council (CXC) examinations in Integrated Science. Notes that the new subject could have benefited initially from 'heavy' marketing and that the slow flow of information from panel and examiners via CXC to science teachers has not been helpful. The need to exploit the full range of strategies for teacher reorientation, for revision of the syllabus, clarification on the issues of practical and project work and for production of written materials, is emphasised.

LANCASTER, C.M. (1979) XI 2013

The assessment of project work in science. Caribbean Journal of Science Education, 1, (April), 19-26.

Reviews the nature and aims of project work found in various science curricula and in light of these, suggests an appropriate assessment instrument for secondary school integrated science programmes in the Caribbean. The five categories for assessment are: statement of the problem, review of resources, selection of approaches, application of information, and communication. These are subdivided into thirty components and rated by an assessor on a five point scale, using a similar technique to Brcomes' "Assessment of Individual Studies".

LEO-RHYNIE, E.A. (1982) JM 2014/101

Educational Research of some graduate students of UWI: a commentary. Caribbean Journal of Education, 9(2), 135-151.

MORA, H., QUESADA, L. and ESQUIVEL, J.M. (1986) CR 2015

The construction of criterion-referenced tests for science education in Costa Rica. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 219-233. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

The tests developed in this study followed the definitions given by Glaser and Nitko (1971) and by Popham (1978). Kuder-Richardson-21 was chosen to estimate their reliability. The tests were administered to a random sample of 4th, 5th, 6th, 7th and 10th graders from 127 public elementary and 43 public secondary schools in Costa Rica. The results obtained showed very little achievement in science, pointing to the urgent need for better in-service teacher training and a revision of the science curricula.

COGNITIVE DEVELOPMENT/CONCEPT ATTAINMENT

Research on these areas falls under the following categories:-

1. Assessment of levels of cognitive development;

2. Cognitive development and curriculum cognitive demands;

3. Concept development in pre-school students;

4. Metacognitive behaviour of successful and less successful students;

5. The acquisition of science concepts at pre-school, primary, secondary and tertiary levels;

6. The effect of science teaching and language on concept attainment;

7. Development of concept attainment test;

8. Use of cognitive structure;

9. Cross-cultural studies of cognitive development, concept learning.

ADEY, P.S. (1976) XI 3001

Two tasks for the assessment of levels of cognitive development in Caribbean junior secondary schools. Caribbean Journal of Education, 3, (April), 112-138.

> Describes task instruments to be used in a proposed survey of levels of cognitive development in junior secondary schools in Jamaica, Barbados, Trinidad and Guyana. The two tasks (Volume and Heaviness, and Dissolution of Sugar) are derived from Piagetian protocols, developed in the United Kingdom and modified for the Caribbean. Validation trials are described and details of reliability, validity and task-task correlation are given.

ADEY, P.S. (1977) BB 3002

The development of concepts in science: A survey of junior secondary pupils in Barbados. St. Michael, Barbados: Ministry of Education.

> Two class tasks were administered to a sample of pupils, aged 11-17 years from one selective and two non-selective schools in Barbados, to assess average levels of cognitive development. Results are presented by age and by school year. In the selective school, virtually all students were

at least at the late concrete operational stage, while the percentage at the early formal operational stage rises from about 25 per cent of 13 year-olds to about 75 per cent of 16 year-olds. About 15 per cent in the 11+ age group in the non-selective schools are still preoperational. The overall difference is highly significant in favour of boys and three hypotheses are proposed to explain this difference. A tentative analysis of the conceptual levels demanded by the West Indian Science Curriculum indicate a mismatch between curriculum demands and the cognitive levels in the schools. The methodology of curriculum analysis needs to be validated further.

ADEY, P.S. (1979) XI 3003

Cognitive development in some Caribbean secondary schools. Caribbean Journal of Education, 6, (September), 197-220.

Two Piagetian tasks were given to 2300 students from nineteen schools in four Caribbean countries: three types of schools were represented: high, government secondary and a combination of new secondary and all-age. The article describes patterns of cognitive development in the different school types and levels of development in each for the first three or four years of secondary education. The author notes differences between patterns by sex and in rates of development per school type. The implication for teaching methods and the curriculum are wide-ranging.

ADEY, P.S. (1979) XI 3004

Science curriculum and cognitive development in the Caribbean. Unpublished Ph.D. dissertation, Chelsea College, University of London, England.

Asserts that a pupil needs to be at a certain stage of cognitive development before he/she can comprehend some curriculum activities with which he/she is presented. Pupils from different types of school in Barbados, Guyana, Jamaica and Trinidad were tested to determine their level of cognitive development in Piagetian terms. The West Indian Science Curriculum (WISC) was also analysed to determine the cognitive level demanded by each of its activities. Implications of both sets of data for the WISC and science curriculum development in general are drawn and tentative recommendations are made for curriculum reform. Research methods are reviewed and possibilities for their improvement are considered.

ADEY, P.S. (1981) TT 3005

The cognitive demands of WISC: can the match be improved? Caribbean Journal of Education, 8, (January), 1-25.

Describes a method for analysing science curricula in terms of the demands they make on pupils' levels of cognitive development, expressed in Piagetian terms and gives examples of its application to the West Indian Science Curriculum. Checks the method's validity by looking at inter-rates reliability and tests the predictions of success and failure made on the basis of the curriculum analysis combined with pupil assessments. Makes recommendations for improving the match of curriculum and pupils.

ADEY, P.S. (1986) XI 3006

Cognitive acceleration - review and prospects. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 84-99. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Research carried out in the Caribbean between 1970 and 1979 revealed that science curricula were making excessive demands on the majority of pupils. Cognitive acceleration - increasing pupils' levels of thinking - is one way of solving cognitive mismatch. The literature on cognitive acceleration is reviewed and a British project, Cognitive Acceleration through Science Education (CASE) is described. The author concludes that there is no reason why the development of curriculum materials, specifically designed to promote cognitive development should not work at least as well in the Caribbean as anywhere else.

ADEY, P.S. and DALGETY, F. (1976) GY 3007

The development of concepts in science: A survey of junior secondary pupils in Guyana. Georgetown, Guyana: Ministry of Education.

Two class tasks were administered to 11-14 year old pupils from five schools, in order to assess typical levels of cognitive development. Results are shown for secondary and all-age pupils first by age and then by school year. Comparison between selective and non-selective schools shows that the levels of development in the former are higher than in the latter. In the selective secondary schools there appears to be a quite sudden growth in the proportion of formal operational thinkers in the fourth year. In the all-age schools, some 30 per cent of pupils in their first year are preoperational. There appears to be some difference in the rate at which boys and girls in secondary schools achieve the concepts investigated and three hypotheses are proposed. An analysis of the conceptual demands of the West

Indian Science Curriculum indicates that much of the curriculum makes demands at the late concrete operational level. This can only be met by 50 per cent of the first year pupils in secondary schools and by not more than 30 per cent of pupils in all-age schools.

ADEY, P.S. and MANBODH, M. (1977) TT 3008

The development of concepts of science: A survey of lower secondary pupils in Trinidad. Port of Spain, Trinidad.

Eight In-Service Diploma teachers administered tasks II and 7 to some 1100 pupils in the 11-15 year age group, in eight schools in Trinidad. Cognitive levels were then ascribed to pupils and results by age and by school year group are presented in tabular format. Results indicate that in the lower range school, some 28 per cent of pupils in the first year are preoperational; there is a striking difference in the percentage of late concrete operational pupils in the upper and lower range schools; and it is not until the fourth year of the more selective schools that many pupils reach the stage of formal operations. Possible explanations for observed sex differences are advanced, as are tentative results of an analysis of the conceptual demands of the West Indian Science Curriculum Innovation Project. Much of the curriculum makes demands at the level of late concrete operations, which can only be met by some 35 per cent of first year pupils.

ALEXANDER, Z.(1982) DM 3009

A study of the science process skills present in pre-school children in Dominica. Unpublished B.Ed. dissertation, University of the West Indies, Cave Hill, Barbados.

Twenty one Piagetian type tasks were administered to 48 3 and 4 year-old children attending the Pre-School Centre in Roseau, Dominica. The children's responses were used to ascertain their level of performance on each task. The results show that observation skills exist; classification skills are present but in some form of hierarchical order for both age groups; seriation of length is poorly developed; conservation of numbers and ordinality are not yet developed; conservation of length is not fully acquired; and children can do simple prediction but have trouble with pattern finding. Significant differences in performance due to age were found for seriation and classification.

DURGADEEN, L. (1986) TT 3010

Elaborations: differences in the metacognitive behavior of successful and less successful students. Unpublished Ph.D. dissertation. Pennsylvania State University, U.S.A.

Scores on teacher made tests were used to rank 88 second year science students in a secondary school in central Trinidad, as successful and less successful. Different subjects chosen from the sample were tested in three phases: (1) subjects received base sentences and were asked to generate endings (elaboration) which would help them remember information supplied in the base sentence; (2) subjects rated a mixture of sentences for comprehensibility; (3) subjects were asked to rate sentences in sets as easy or difficult to remember. Cued recall tests were administered after each phase. The study showed that successful students generate significantly more precise elaborations than less successful students and the precise elaborations facilitated recall even when students were unaware of the powerful effect of precision on retention. The success of training in elaborative activities indicates that some students suffer from a mediational or production deficiency since they may have the required knowledge and skills but fail to employ learning strategies spontaneously.

DURGADEEN, L. (1986) TT 3011

A theoretical framework for research in science curriculum implementation strategies. Paper tabled at the Regional Consultation on Science Education Research in Latin America and the Caribbean, Port of Spain, Trinidad, 12-15 February.

Curriculum development in the Caribbean has been based mainly on a Piagetian rationale, the emphasis being on the need to match the cognitive demands of a programme with the intellectual development of the students. This paper describes two research frameworks in cognitive psychology - the levels of processing model and schema theory - with implications for science education research and focuses on 'elaborating' as an effective information processing strategy. The findings of a study of the elaborative activities of some secondary school students in Trinidad are presented.

DURGADEEN, L. (1987) TT 3012

Elaborations: differences in metacognitive behaviour of successful and less successful science students in Trinidad. Paper presented at the 60th National Association for Research in Science Teaching Conference, Washington, D.C., U.S.A., April 23-25.

Elaboration is the manner in which learners embellish and encode knowledge. For elaborations to facilitate learning and enhance memory, they must be precise and represent a non-arbitrary association between the to-be-learned material and the learner's prior knowledge. The study described here, sought to assess the effect of precise and imprecise elaborations on the science learning of successful and unsuccessful secondary science students. For further details see the author's Ph.D. dissertation.

EDWARDS, E. (1986) VC 3013

The effects of two teaching methods and the utilisation of advance organisers on the meaningful acquisition of science concepts and principles among a sample of teachers at the St. Vincent teachers college. Unpublished B.Ed. dissertation, University of the West Indies, Cave Hill, Barbados.

Thirty-two first-year student teachers were randomly assigned to four treatments. A unit of work on acids, bases and salts was presented to the four groups in five one-hour periods, spread over two weeks. A 25-item multiple choice test was administered 72 hours after the treatment to measure students' learning and retention. A science attitude scale was also administered to the students. Concludes that advance organisers are useful in improving overall acquisition of science concepts and principles, but students' attitude to science is an important contributing factor to the amount of learning which takes place.

ELRINGTON, B. (1984) BZ 3014

An investigation of the effects of two science projects on science process skills among primary school students in Belize. Unpublished B.Ed. dissertation, University of the West Indies, Cave Hill, Barbados.

To determine whether students pursuing the Rural Education Agricultural Project (REAP) and the Senior Primary School Science Curriculum (SPS), developed equally the science process skills of observation classification and measurement, a test was developed and administered to a random sample of 72 students: 36 each from REAP and SPS schools, equally divided between girls and boys. The Science Process Skills Test was supplemented by a battery of seven Piagetian tasks. The study found that: students developed equally the three science process skills; there was a significant difference in the extent to which boys and girls developed these skills; and a difference in readiness and maturity levels as measured by Piagetian tasks had no effect on students' performance of science process skills.

FRASER-ABDER, P. (1978) TT 3015

Concepts in science teaching. Journal of Education in Science for Trinidad & Tobago, 5, (November).

An overview of the development of concepts in science in primary level students. Discusses the characteristics of Piaget's intellectual stages.

FRASER-ADBER, P. (1982) TT 3016

The effect of science teaching on the Trinidadian fifth grade child's concept of Piagetian physical causality. Caribbean Journal of Education, 9, (September), 167-187.

Reviews Piagetian research in the Caribbean and summarises the methodology and findings of the present study, further details of which can be found in the author's Ph.D. dissertation of the same year.

FRASER-ABDER, P. (1982) TT 3017

An experimental study into the effect of science teaching on the Trinidadian fifth-grade child's concept of Piagetian physical causality. Unpublished Ph.D. dissertation, Pennsylvania State University, U.S.A.

A sample of 835 children from 37 schools was divided into experimental and control groups. The former received science instruction, the latter, language arts instruction. Tests used were the Concept Assessment Kit - Conservation Forms A and B, the Metropolitan Achievement Test, Form C and two clinical interviews which assessed the child's concept of living and floating. The experimental group scored significantly higher than the control group; girls scored significantly higher than boys for the concept of living; verbal ability scores and clinical interviews were highly correlated; and significant differences were found between the child's stage of development and the concept of living. Concludes that participation in selected science experiences tended to enhance the development of the concepts of living and floating and that causal relationships of animism and dynamism could be taught to fifth-grade Trinidadian children.

FRASER-ABDER, P. (1985) TT 3018

The status and implications of the cognitive developmental levels of elementary students in Trinidad and Tobago. Journal of Education in Science for Trinidad and Tobago, 12 (May), 1-6.

Describes a study to determine the status of cognitive development of primary school students in Trinidad and Tobago, for use in elementary science curriculum development. Results indicate that 43% of 11-12 year olds are about to enter the mid-concrete stage, 32% are still at the preoperational level, 22% are at the mid-concrete stage while fewer than 4% are about to enter the formal level. Secondary science curriculum developers will have to make some effort to achieve some match between the cognitive demands of the curriculum and students' cognitive levels.

FRASER-ABDER, P. (1986) TT 3019

Sub-cultural differences in cognitive development among elementary students in Trinidad and Tobago. Caribbean Journal of Education, 13 (January-April), 27-41.

Report of a study which examined the relationship between cognitive developmental level of a sample of 6686 elementary school students, and gender, age, school administration, school type and socio-economic level. Some conclusions are that females had a tendency to achieve a higher concept developmental level than males; the majority of pupils did not conform to the Piagetian age-stage relationship; children at private schools tended to achieve a higher concept developmental level than those at denominational and government schools; the children of university graduates achieved better than those of non-graduates.

FRASER-ABDER, P. and FOWLER, H.S. (1981) TT 3020

The cognitive developmental level of elementary school students in Trinidad and Tobago. Paper presented at the 54th Annual Conference of the National Association for Research in Science Teaching, New York, U.S.A., April 5-8.

A sample of 6686 pupils, ranging in age from 5 to 15 years, was randomly selected from the various school types, localities, and cultural, social and racial backgrounds. The investigation involved only a post-test. Operational Task No. 1 of the Science Reasoning Tasks developed at the Chelsea College Centre for Science Education (U.K.) was selected to assess level of cognitive performance. Results indicated a steadily decreasing proportion of pupils from age 5 to 11 years at the pre-operational stage; a steady increase to age 10 followed by some fluctuation and ending with a high proportion at age 15 at the transitional stage; an increase to age 11 followed by a decrease to age 15 at the concrete operational stage. Concludes that it was possible to classify the cognitive developmental levels of Trinidadian pupils according to Piagetian stages.

FRASER-ABDER, P. and FOWLER, H.S. (1983) TT 3021

An experimental study into the effect of science teaching on the Trinidadian fifth grade child's concept of Piagetian physical causality. Paper presented at the 56th National Association for Research in Science Teaching Conference, Dallas, Texas, U.S.A., April 5-8.

Presents the results of a study which investigated the effect of science experiences provided by the classroom teacher on the fifth grade Trinidadian child's concept of Piagetian physical causality. For further details see Fraser-Abder's Ph.D. dissertation (1982).

FRASER-ABDER, P., GANN, L. and HANN, A.C. (1987) TT 3022

Teaching, gender, verbal ability and the development of a concept of living and floating - A cross-cultural comparison. Journal of Science and Mathematics Education in Southeast Asia, forthcoming.

This study is a cross-cultural comparison of the effect of science teaching, gender and verbal ability on the 8 1/2 - 10 1/2 year old Trinidadian, American and Korean child's concept of Piagetian Physical Causality in particular the concept of living and floating. The subjects were 835 Trinidadian, 114 American and 208 Korean students. Pretesting involved the Metropolitan Achievement Test and the Concept Assessment Kit. Treatment for the control group was 10 language arts lessons, while for the experimental group it was 10 science lessons. Post test involved the Concept Assessment Kit and 2 clinical interviews. Chi-square, Correlation Coefficients and 't' test were used to analyse the data. The authors conclude that: 1) the causal relation of animism and dynamism can be taught to 8 1/2 - 10 1/2 year old Trinidadian, American and Korean children; 2) the effect of gender on the child's ability to benefit from science teaching is culture dependent; 3) in all three cultures,there is a high correlation between verbal ability and the ability to attain specific concept development.

FRASER-ABDER, P. and ISAACS, P.A. (1985) XI 3023

Cognitive development among grade 1 and 2 students in some Caribbean islands. University of the West Indies, St. Augustine, Trinidad.

This study attempted to determine the cognitive developmental level attained by Grades 1 and 2 students in some Caribbean islands and determine whether differences exist in the attainment of the cognitive development level by students in the different islands. The sample comprised 1621 first grade students and 1414 second grade students from six Caribbean islands. The study involved the administration of the Concepts in Secondary Mathematics and Science Programme Operational Task 1 to the students. In both Grades 1 and 2 the majority of the students were still at the pre-operational stage. About 27% of Grade 1 students were at the concrete and early formal level; 43.4% of the Grade 2 students were at the concrete level but none were at the formal level. There were some differences in the attainment of cognitive development among students in the islands studied. In St. Lucia, two Grade 1 students were found to be at the early formal level, while in Barbados the highest level attained was the early concrete level. In Jamaica and St. Kitts the mid-concrete was the highest level attained while the highest level in Trinidad and Tobago was the late concrete. The highest level attained in Grade 2 was the late concrete in Trinidad and Tobago and the mid-concrete in the other countries.

ISAACS, P.A.(1976) JM 3024/402

Some conservation concepts in Jamaican grade six students. Unpublished M.A. thesis, University of the West Indies, Mona, Jamaica.

ISAACS, P.A. (1980) XI 3025

Piaget's theory and the Caribbean. Caribbean Journal of Education, 7 (2) 110-130.

> Claims that Piaget's theory has been given insufficient attention in the West Indies and that such attention could be of immense practical help in educational planning. An overview of the theory and of the Caribbean research based on it is given.

ISAACS, P.A. (1981) JM 3026/403

Preparation and validation of a videotaped test of conservation suitable for grade six students in Jamaica. Unpublished paper. Mona, Jamaica: School of Education, University of the West Indies.

ISAACS, P.A. (1984) XI 3027

Development of a test of process skills for grade 3 elementary school pupils. Paper presented at the 57th Annual Conference of the National Association for Research in Science Teaching, New Orleans, U.S.A., April 1984.

> Few valid and reliable tests exist for the assessment of the development of process skills. The Show Your Skills test, currently under development is designed to meet the following criteria: 1. It should test process skills taught in the first three years of schooling; 2. Its content should not be slanted towards any particular subject on the curriculum; 3. It should be capable of being administered to a class-sized group; 4. It should assume very low levels of reading ability and be structured so that it can be read aloud to the class. The three versions of Form 1 were administered to 318 Jamaican students in Grade 3 classes in the ten rural elementary schools. The mean of Form 1 was 20.67 with a standard deviation of 6.6. A Cronback alpha of 0.85 was obtained. Six of the items had a facility of 0.32 or less, six items had a facility of 0.75 or greater. Discrimination indices were also satisfactory. Currently, plans are underway for testing all six versions of the test simultaneously with students of the same age in Barbados, Belize, and Jamaica. It is hoped that the result-ing tests will be a useful resource for assessing the levels of development of the process skills, whether for research purposes or in the evaluation of student learning due to curriculum development.

KING, W.K. (1978) XI 3028

The interpretation of Piagetian developmental psychology in terms of primary science - the need for research. Report of proceedings of the Regional Primary Science Conference, pp 84-94. Cave Hill, Barbados: Caribbean Regional Science Project.

Interpretation of Piaget's developmental theory based on a 1972 conference paper by Joan Bliss. It's application to primary science is discussed with reference to Science 5/13, a project of the Schools Council, Nuffield Foundation and Scottish Education Department. Lessons to be learnt from the study of the stages of development in children, include the following: children seem to perform best when they are actively involved in the learning situation; and, as far as possible, concrete examples should be used at the lower stages until the power of abstraction develops. Among areas identified for research are: comparative study of the development of science/mathematics concepts between groups stratified by relevant variables; cognitive growth of children in the Caribbean; study to establish whether Piaget's stages are applicable to children in the Caribbean; and studies to identify the science/mathematics concepts which children have upon entering primary school.

LOWE, M.T. (1969) GY 3029

Use of cognitive structure by low creativity high intelligence subjects and high creativity average intelligence subjects. Unpublished M.A. dissertation, Dalhousie University, Canada.

Sixth grade school children were classified into four groups as follows: high creativity - high intelligence, low creativity - high intelligence, high creativity - average intelligence, low creativity - average intelligence. They were divided into control groups - without a cognitive structure and experimental groups were with a cognitive structure - the Reynolds 1966 map. Consonant-vowel-consonant combinations were used as labels on the map. Scores from paired associate learning were subjected to an analysis of variance and results interpreted from both cognitive and associationist points of view. The study concluded that highly intelligent students make greater use of their cognitive structure than highly creative students when both subsume convergent thinking material. The findings supported one aspect of Mednick's theory of the associative basis of creativity.

McGREEVY, P.F. (1977) PR 3030

A comparative study of the effects of linguistic and non-linguistic variables on the performance of urban Puerto Rican elementary pupils when tested with the WISC and de Avila's cartoon conservation scales. Unpublished Ed.D. dissertation,

Boston College, U.S.A.

MITCHELMORE, M.C. (1982) JM 3031/404

Knowledge of basic geometrical concepts among Jamaican school children. Caribbean Journal of Education, 9 (1), 14-31.

SARLABOUS, M.A. (1981) CU 3032

Formation of the scientific concept of the world in students. Revista Cubana de Educacion Superior, 1 (enero-marzo 1981), 1-15.

> This study examines the peculiarities of the formation of the scientific concept of the world by students of tertiary teachers colleges. The degree of the formation of concepts in relation to subject matter and knowledge was studied. The results indicate that the students were still at the stage of unifying their daily concepts and their scientific concepts into one system.

THAKUR, P.S. (1975) XI 3033

A comparison of West Indian and American undergraduates on selected cognitive factors. Unpublished Ph.D dissertation, New York University, U.S.A.

> One hundred and fifty-six (156) West Indian and 106 American undergraduate students were tested on 6 cognitive factors with the following results: West Indians had higher memory scores than American students, but lower scores on Verbal Comprehension, General Reasoning, Spatial Scanning and Inductive Thinking; there was significant difference between the groups on Ideational fluency. Each factor had a composite of two tests and these were also considered for their contribution to the group variance.

THOMAS, E. (1981) XI 3034

An investigation into some aspects of Piagetian and Brunnerian ideas on the conservation of liquid quantity in children aged between 4-8 years drawn from populations differing in ethnic origin and SES. Unpublished M.A. dissertation, London University, England.

> The study explores the conservation of liquid quantity among three samples differing in socio-economic status and ethnic grouping. The sample included 80 white middle SES children, 70 Caribbean working class children and 35 white working class children. The results indicate a relationship between pretest performance and attainment of conservation. The author concludes that the use of certain words employed in conservation procedures needs to be examined further and could form the basis of future research.

WHITE, A.L., BERTY, R., BERLIN, D.,
FRASER-ABDER, P., and ESQUIVEL. J. M.(1985) XI 3035

An international consortium for concept learning research in four countries - USA, Trinidad & Tobago, Costa Rica and Mexico. Symposium presented at the 58th Annual Meeting of the National Association for Research in Science Teaching, French Lick Springs, Indiana, U.S.A., April.

Research in education is very much influenced by the specific samples and conditions of the research. It becomes extremely important to have replication of research in order to identify those findings which have stability and consequently the generalizability needed to build a knowledge base. In order to establish a broad base it is valuable, and perhaps necessary, to have co-operative efforts in a variety of settings to test the hypotheses and the practical application of the theories. The first level of co-operation at the university was between the main campus faculty and the branch campus faculty. This provided a broader base for sampling and a valuable perspective for the needs and adjustments for experimental procedures. In addition, co-operative efforts in the form of an international consortium have been developed. The needs, resources, and cultural differences of the institutions and their representatives from Costa Rica, Trinidad and Tobago, and Mexico provide opportunities for: (a) replication to establish new generalisations or reaffirm previous ones; (b) expansion of the generalisations to a broader population; (c) Indentification of the differences in populations and the relevance of the generalizations; (d) extension of the generalisation to other modes, and (e) clarification of the concept of transition as a part of cognitive development.

The representatives of each of the countries (Costa Rica, Trinidad and Tobago, Mexico and the United States) discussed goals and directions for science education research in the country and needs and resources for effective science education research in the country and role of a science education research consortium in the improvement of the research program in the country. The current research topic of the Consortium is the use of technology to facilitate the transition of young children from concrete understanding of concepts to abstract thought.

CURRICULUM DEVELOPMENT/IMPLEMENTATION/EVALUATION

Research in this area has been most prolific. There is need, however, to pool resources since in most of the islands students are being prepared for the same final examination. Research could be subdivided into the following areas:-

1. Development, implementation and evaluation of primary and secondary science curricula;

2. Teacher training and curriculum development model;

3. Problems in curriculum development, implementation and evaluation;

4. Curriculum content;

5. Overview of science curricula;

6. Influences on the practice of science curriculum.

ADEY, P.S., REAY, J.F. and TURNER, A.D. (1973) XI 4001

An evaluation of new junior secondary science curricula in the Caribbean - interim report. St. Augustine, Trinidad: University of the West Indies.

> This evaluation of the West Indian Science Curriculum Innovation Project (WISCIP) and the Science Education Project at Mona, Jamaica, tested pupils following each pilot curriculum against pupils from non-pilot schools. Results indicated that the pilot curricula had a significant beneficial effect in Barbados and Jamaica in general; however in junior secondary and comprehensive schools in Barbados, WISCIP pupils and in Jamaica, Mona pupils performed no differently from non-pilot pupils. There was no significant difference among most territories using WISCIP except that Jamaican performance was relatively high and St. Vincent performance was relatively low.

ALEXANDER, G. and GLASGOW, J.L. (1981) JM 4002/901

UNICEF Regional Primary School Project: Report on teacher training and curriculum development activities 1978-1980. Caribbean Journal of Education 8(1), 75-101.

BROOMES, D.R. (1980) XI 4003

Problems of defining the mathematics curriculum in rural areas. Paper presented at 4th International Congress on Mathematical Education, Berkeley, California, U.S.A., 10-16 August.

BROOMES, D.R. (1982) XI 4004

Constructing and organising mathematics programmes in teachers' colleges. New role for changing needs and aspirations. Edited by W. King. Cave Hill, Barbados: School of Education, University of the West Indies.

BROOMES, D.R., SCHROEDER, T.L., and PAYNE, R.D. (1974) XI 4005

Mathematics curriculum and evaluation: Caribbean experiences. Educational Development International, 2 (April), 67-73.

> Examines certain features of the Caribbean Mathematics Project, a curriculum development project for pupils in the 12-15 age group. Three types of strategies - Curriculum Development, Mathematics Curriculum and Mathematics - have been implemented by means of round table meetings, workshops, action research and school visits. The way the learning process has been conceptualised and the way in which the teaching act and curriculum development have been formulated have facilitated the emergence of three types of evaluation procedures: initial, formative and summative.

BROOMES, D.R. and KUPERES, P.K. (1983) XI 4006

Problems of defining the mathematics curriculum in rural communities. Proceedings of the Fourth International Congress on Mathematical Education, pp. 708-711. Edited by M. Zweng, et al. Boston: Birkhauser.

> Ruralisation of primary education implies inter-alia, that primary mathematics education should be designed to ensure at least a threshold level of mathematical learning required for effective participation in rural communities. Three examples in the instructional design of mathematics education are given: a village water-supply scheme, the school farm plot and constructing a hen-house. Three strategies for developing, implementing and evaluating an appropriate mathematics curriculum for rural communities are discussed. The first emerges from a search for answers to the question: what part should mathematics play in education and in the curriculum of all children? The second is a community involvement strategy and the third, an evaluation strategy.

BULLEN, T.G. (1983) XI 4007

Improvised apparatus: a lab on a shoestring. Physics Teacher, 21 (May), 292-98.

Discusses the construction of various types of physics equipment from laboratory "bits and pieces". Refers to similar work being done in schools in Peru and the Caribbean.

CLARKE, E. (1979) JM 4008/902

The preparation of high school students in mathematics for the world of work in Jamaica. Unpublished M.A. dissertation, University of the West Indies, Jamaica.

CONWAY, J.R. (1983) USVI 4009

Development of an interim biology course in the Virgin Islands. Journal of College Science Teaching, 12, (May), 399-403.

Tropical Biology was designed as a general introductory course to fulfill the interim requirement (two courses during the four-year period) for students at Elmhurst College (Illinois). The idea of conducting the course in the Caribbean occurred to the author while on holiday in St. John in 1972. Course objectives included: to familiarise students with the biological beauty and diversity of the tropics, to expand awareness and appreciation of life through observation of new organisms, cultures and lifestyles; and to foster a lifelong interest in learning in general and tropical biology in particular. Students were evaluated quantitatively on a research paper and oral summary, daily log of the trip and observations, and quizzes.

COURT, I. (1972) PR 4010

In-service training problems in introducing a foreign-based science curriculum into Puerto Rico. Unpublished Ph.D. dissertation, University of Illinois at Urbana-Champaign, U.S.A.

In 1971, a ten-week in-service teacher training programme was convened to introduce the Harvard Project Physics Curriculum into senior high schools in Puerto Rico. Twenty-six science teachers participating in the course were interviewed to find out their attitudes towards teaching a foreign-based curriculum and to determine the factors which govern the successful implementation of such curricula. The study revealed that three factors affect the teaching of science in Puerto Rico: students' and teachers' lack of training in mathematics, the general apathy and disdain for reading in the schools, and the paucity of science teaching facilities and materials. Recommendations for further research and for improving science teaching are made.

CUNDY, H.M.(1976) XI 4011

Caribbean Mathematics Project: an evaluation study. London: The British Council.

The Caribbean Mathematics Project, was implemented during the period 1971-1975 in eight Eastern Caribbean countries. The report traces its history and its strengths and weaknesses, against the political, economic, social and pedagogical background of the region.

CUNDY, H.M. (1977) XI 4012

The Caribbean Mathematics Project: the teachers as the agent of reform. Study prepared for the International Educational Reporting Service. Paris: Unesco. (Experiments and Innovations in Education, no.32).

Traces the background and initiation of the project and describes its development and operation. Evaluates the achievement of the project and factors militating against total success. Lessons to be learnt are discussed under six headings: content and method, teacher training, curriculum and syllabus, the lowest streams, assessment of the project and potentialities for the future.

DALGETY, F. (1983) GY 4013

Equipment for primary science. New trends in primary school science, Vol.1, pp. 133-148. Edited by W.Harlen. Paris: Unesco.

Addresses the problems of the provision of primary school science materials and equipment in developing countries. Outlines a six-stage plan for decision-making about production of and evaluation of the supply of equipment. Presents the findings of a recent survey of materials and equipment needs at each level of primary education in Guyana.

DIAZ, C.J. (1983) GY 4014

Bulletin of Technical File Cards on Low-Cost Equipment for Science Teaching. UNESCO Regional Office for Education in Latin America and the Caribbean.

First issue of a Bulletin of file cards for exchange of information on prototypes for the manufacture of low-cost equipment for science teaching.

DOUGLASS, R. and DURGADEEN, L.(1980) TT 4015

Primary school science. Social Studies Education, 17 October, 10-13.

The article briefly traces the development of SAPATT Science - A Process Approach for Trinidad and Tobago, which

is the science programme currently in use in primary schools in that country. A sample lesson used for teaching teachers how to use curriculum material is included.

DYER, C.V. (1974) TT 4016

A study to determine curriculum content for industrial arts in the junior secondary schools of Trinidad & Tobago. Unpublished Ed.D. Dissertation, Arizona State University, U.S.A

This study developed a curriculum guide for industrial arts education that was especially suitable to the new Junior Secondary schools of Trinidad and Tobago. The author studied recent developments in vocational-technical education, and made some observations and suggestions for its improvement. The study concluded that: (1) Trinidad & Tobago can benefit from those experiences which were obtained in the development of industrial arts education in the United States of America; (2) The new junior secondary schools of Trinidad & Tobago offered an opportunity to change and improve the methods of teaching industrial arts. (3) The industrial arts curriculum project should be used as a pattern for such change in the Trinidad & Tobago industrial arts education. Included among the recommendations was that the teaching of industrial arts and science be very closely interrelated.

ECK, D. (1986) BZ 4017

Relevant education for agriculture and production (REAP). Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 115-120. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

REAP demonstrates that teaching science yields positive results when the curriculum relates to the child's environment and the method of teaching is practical. The curriculum is characterised by integrating nine areas of study (village/urban study, land and water, ecology, weather, agricultural practices, health and nutrition, animals and plants) into traditional academic subjects. The Government of Belize considers the programme highly successful and can assist countries in setting up similar programmes.

FRASER-ABDER, P. (1984) TT 4018

Science in the primary schools. Victoria Annual 1983-1984, pp. 127-137. [San Fernando], Trinidad: Ministry of Education, Victoria Education Division.

Briefly discusses the philosophy and processes used in the primary school science curriculum in Trinidad and Tobago and offers suggestions for teachers to help pupils learn science.

FRASER-ABDER, P. (1985) TT 4019

The development of primary science education in Trinidad and Tobago. Caribbean Curriculum, 1 (May), 55-67.

Despite the existence of the primary science syllabus of 1956 and 1975, little science was taught in primary schools in Trinidad and Tobago. In 1977, the Ministry of Education and the School of Education launched an elementary science curriculum development programme. The current curriculum, Science - A Process Approach for Trinidad and Tobago, was developed for children 5-12 years old. Seven hundred teachers were involved in its development from 1977-1983. Implementation continues to date with work being done both with students and teachers.

FRASER-ABDER, P. (1985) TT 4020

Development, implementation and evaluation of the Science - A Process Approach for Trinidad and Tobago (SAPATT) science curriculum (Phase 1). Paper presented at the 58th Meeting of the National Association for Research in Science Teaching, French Lick Springs, Indiana, U.S.A., 15-18 April.

Traces the development of the elementary science curriculum in Trinidad and Tobago and identifies problems that have influenced science instruction and/or the lack of it. Presents a model for teacher involvement in elementary science curriculum development, through which seven hundred teachers were involved with curriculum development from 1977-1983.

FRASER-ABDER, P. (1986) TT 4021

A model for teacher involvement in elementary science curriculum development. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp.166-181. Edited by P.Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Discusses seven stages in the development of an appropriate elementary science programme. They are: (1) review of existing elementary science curricula; (2) literature review; (3) consultation; (4) research; (5) syllabus

development; (6) curriculum development; (7) production of curriculum material. Stages 1, 2, 3, 4, 5 and 7 should be carried out by a Core Curriculum Committee (CCC) while stage 6 should involve the CCC, teachers and students. A model for teacher involvement in curriculum development is outlined.

FRASER-ABDER, P.(1987) TT 4022

An analysis of parent, student and teacher evaluation of an elementary process - approach curriculum. Paper presented at National Association for Research in Science Teaching 60th Conference, Washington, D.C., U.S.A. April 23-25.

Two hundred and fifty parents, 700 students and 300 teachers were randomly selected to respond to questionnaires which assessed: parental involvement; parental perception of student enjoyment; parental opinions of science teaching and its effect on the child; student and teacher interest in the curriculum; student enjoyment, understanding and participation; teacher evaluation; difficulties in teaching the programme; usefulness of teachers' guides; and effectiveness of implementation strategies. The findings indicate that most parents, students and teachers found the curriculum to be exciting, effective and interesting. Further in-service training for teachers is necessary to ensure longevity and effectiveness of the curriculum. The data suggest that the nature of the curriculum allows teachers to present a positive and exciting image of science.

FRASER-ABDER, P. and DOUGLASS, R. (1986) TT 4023

A curriculum journey: Science - a Process Approach for Trinidad and Tobago (SAPATT). Science Education Research in Latin America and the Caribbean: Proceedings of a Conference pp.100-114. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Traces the evolution of SAPATT, the science curriculum for primary schools of Trinidad and Tobago. The initial phase comprised a review of existing primary science curricula, a literature review, research and consultations and workshops. The syllabus comprised philosophy, aims, content, processes and objectives for each primary school year. Curriculum implementation, provisions for evaluation and problems encountered are also described.

GARDNER, M.(1975) XI 4024

A myriad of patterns on the international scene. School Science and Mathematics, 75 (January), 69-79.

Describes integrated science activity by Unesco in the Phillipines, Singapore, Thailand, Malaysia, Japan, Australia, The United Kingdom, Israel and The Caribbean.

GLASGOW, J. L. (1977) JM 4025/701

Science in the Jamaican community: A survey of some aspects of the provisions for training in science. Unpublished M.A. dissertation, University of the West Indies, Jamaica.

GORDON, J.S. (1976) PR 4026

Mixed dominant grouping and bilingual materials in mathematics and science classes in two Puerto Rican junior high schools. Unpublished Ph.D. dissertation, University of Illinois at Urbana-Champaign, U.S.A. Abstract unlocated.

HAMILTON, M.A. (1976) JM 4027/903

The development of an introductory ecology course for third year students in secondary schools of Jamaica. Science Education Newsletter, 7 (3), 14-22.

HILL, E. (1982) AG 4028

CXC Integrated Science - To integrate or not to integrate? Unpublished M.Ed. dissertation, University of Reading, England.

> Examines the advantages and disadvantages of the Caribbean Integrated Science Curriculum (CISC) with special reference to student and teacher attitudes to science education and student performance in science in Antigua-Barbuda. Non-integration is preferred because: many of the new teaching methods of integrated science can be incorporated into the traditional science course; there is insufficient evidence of three-subject integration in CISC to necessitate the development of a new course; the high conceptual demand of CISC means that it will cater only for about the top 20 per cent of the student population; and few competent teachers exist. Recommends complete revision of the current Chemistry, Biology and Physics syllabuses; that compulsory science education for the first three years in all schools should take the form of an integrated science course; every effort should be made to explore the most effective methods of school-based assessment in the separate sciences.

HOOPER, I. and BROOMES, D.R. (1967) JM 4029

Content in mathematics for teachers' colleges. Vol. 2 of Mathematics Study Conference Vol. 2 of Report. 3 Vols. Cave Hill, Barbados: Institute of Education.

> This volume is made up of four parts: content of suggested topics; some teaching methods based on the topics; a suggested order for a syllabus; and deductive reasoning. The volume is a compilation of the data set down by the mathematics study conference.

ISAACS, I.A. (1982) XI 4030

Carimaths: The First Conference of Caribbean Mathematics Teachers. Caribbean Journal of Education, 9(3), 243-248.

> The theme of the Conference was "Mathematics for the Benefit of the Caribbean Communities and Its Reflection in the Curriculum". This was reflected in the focus of most presentations on the mathematics of the ethnic and social groups present in the various societies. Other areas looked at were the development of mathematics curricula in the Caribbean and Suriname; the state of mathematics in secondary schools in the Dominican Republic and Suriname; and the possible effects of the use of microcomputers in schools on mathematics. A complete list of the Conference Papers is provided.

JAMAICA. MINISTRY OF EDUCATION. RESEARCH SECTION (1982) JM 4031/904

World Bank 111 Pre-Investment Curriculum Material Project. Research Bulletin, (July).

KING, W.K.(1978) XI 4032

The development of an integrated science programme for the Caribbean. Bulletin of Eastern Caribbean Affairs, 4, (March/April), 1-14; (May/June), 23-30.

> This two-part article examines the origins and development of the Integrated Science programme for Caribbean secondary schools. Part 1 outlines the philosophy, objectives, curriculum and contents of WISCIP/A, the Mona Project, WISC and Grades 10-11 Science Curriculum (Jamaica). Part 2 deals with the curriculum for pupils 14 years and over and includes a review of the teachers' colleges curricula.

KING, W.K. (1979) XI 4033

A primary science curriculum development in a small Caribbean island. Science education for progress: A Caribbean perspective, pp. 24-30. Edited by C.Lancaster and W.King. London: International Council of Associations for Science Education.

> This case study describes the rationale and strategy used in development of a primary science curriculum and identifies the roles played by science teachers, personnel in the Ministry of Education, and educational consultants in its development, diffusion and implementation.

KING, W.K. (1980) XI 4034

Biological education and community development - a Caribbean perspective. Biological education for community development, pp. 44-49. Edited by P.J. Kelly and G. Schaefer. London: Taylor and Francis.

Identifies six trends influencing the biology curriculum in the Caribbean region. They are: the search for more and better food sources, the shift towards family planning, the focus on disease prevention and control, growing emphasis on environmental education, the need for Caribbean peoples to understand racial differences, and the demystification of mental illness. Two constraints to the role of biological education in community development are external examination syllabuses and a strange notion of what community development entails.

KING, W.K. (1980) XI 4035

Patterns of science curriculum development in the Caribbean. World trends in science education. Edited by C.P. McFadden. Halifax: Atlantic Institute of Education.

A critical review of five models of curriculum development in the Caribbean region, establishing an evolutionary development from Model 1 to Model 5. Postulates the importance of curriculum diffusion and implementation in any meaningful curriculum innovation.

KING, W.K. (1982) XI 4036

Integrated science to 'O' Level - a Caribbean case study. World views on science education. Edited by V.N. Wanchoo. New Delhi: Oxford and IBH.

Traces the nutrition, development, diffusion and implementation phases of the Caribbean Integrated Science Curriculum at the secondary level and outlines some of the barriers to implementation. These are teacher re-orientation, the lack of resources and facilities, an adequate innovation climate and textbooks and reference materials.

KING, W.K. (1985) XI 4037

Influences on the practice of science curriculum innovation in the Caribbean. Journal of Education in Science for Trinidad and Tobago, 12 (February), 1-7; (May), 7-13; (October), 1-5.

This three-part article looks at the influences on the practice of science curriculum innovation under three broad headings: socio-historical, contextual and internal. Among the socio-historical factors initiating the debate and eventually, curriculum developments in the region were the establishment of the University College of the West Indies,

social movements, advances in scientific knowledge and curriculum developments in other countries. Contextual factors include the nature of the subject matter, school climate and the communication of information about curriculum innovations. Internal factors include teacher re-orientation and training, teachers' perceptions of aims and the age and ability of pupils. A model for science curriculum innovation is proposed, with far-reaching implications for educational systems in the Caribbean. General science curriculum-specific recommendations are made.

KING, W.K. (1987) XI 4038

Social and cultural responsibilities of science in the school curriculum: objectives and teaching methods. Caribbean Curriculum 2, (1) in press.

Examines the social and cultural responsibilites science in an attempt to devise meaningful strategies to chart the way forward. Concludes with suggestions of some objectives and teaching methods which seem relevant and feasible for the Caribbean.

LAMBERT, E.N. (1979) XI 4039

Towards the implementation of integrated science at the secondary level. New Trends in integrated science teaching, volume v, pp. 69-75. Edited by J. Reay. Paris: Unesco.

The failure of curriculum projects to make significant impact on the life and learning of young people has been attributed to the gap between curriculum developers' ideas and the reality of what happens in school. This gap can be reduced if development of materials, dissemination and implementation are planned from the start and occur concurrently. Advertising and marketing strategies for implementation and hindrances to successful implementation are discussed. The latter relate to insufficient resources, public examinations, insufficient preparation of teachers, and the socio-cultural context.

LANCASTER, C.M. (1978) XI 4040

A view of science education in the Caribbean. Report of proceedings of the Regional Primary Science Conference, pp. 115-123. [Cave Hill, Barbados]: Caribbean Regional Science Project.

Describes developments in science education in the Caribbean. These include the development of primary science curricula in several territories, based on Piagetian development levels; the West Indian Science Curriculum (WISC) at the Junior Secondary level; the Caribbean Integrated Science Curriculum at the Senior Secondary level and the introduction of a science curriculum into the seven teachers' colleges of the Eastern Caribbean. Among eight

difficulties identified are: teacher resistance, the high wastage of science teachers, the high cost of science equipment and the question of 'productivity'. Possible solutions to these problems have emerged. Concludes that three of the major needs arising out of the likely thrust towards the primary sector in the near future, are: the correlation of scientific abilities with Piagetian stages of development of children in the Caribbean; the identification of scientific abilities of pre-school children; and the implications of such developments for teacher education.

LANCASTER, C.M. (1979) XI 4041

A primary science curriculum development in a small island state. Science education for progress: A Caribbean perspective, pp 30-39. Edited by C.Lancaster and W.King. London: International Council of Associations for Science Education.

Describes the rationale for, strategy and tactics used in developing a primary science curriculum in a small Caribbean island group. Concludes that the strategy was successful because the key people were involved at all stages.

LANCE, R.S. (1984) DM 4042

Some aspects of science curriculum development, dissemination and implementation in the English-speaking Caribbean, with special reference to Dominica. Unpublished M.Sc. dissertation, University of Reading, England.

Examines decision-making, communication, selection of content, teaching methods and the language of instruction, resources in curriculum development, dissemination and implementation of a science curriculum in the Caribbean with particular relevance to Dominica. Curriculum development in Dominica is placed in an historical and economic context. A strategy for development, dissemination and implementation of a science curriculum is proposed for Dominica. This strategy, reflects national goals and aspirations, while being pragmatic, taking into consideration the peculiarities of the small island nation, its resources and situation of its teachers. It reflects an understanding that curriculum implementation can only occur in the classroom, where the teacher is the authority. It is recognised that successful implementation of curriculum is dependent on the resolution of a number of non-curricular problems, in the classroom. Some of them involve deep moral problems and conflicts. In this regard the teacher will need every bit of assistance. Periodic meetings with teachers on a district and island-wide level to deal specifically with these 'nitty-gritty' problems are recommended. In some cases the entire community may have to be involved in the resolution of some of the problems.

LOWE, N.K. (1983) XI 4043

Recent developments in the production of school science equipment. London: Commonwealth Secretariat.

Highlights centres throughout the world where school science equipment is being produced at low cost. Caribbean countries included are Barbados, Guyana and Jamaica. Provides insights into the training required for science equipment production and offers a medium for communication between those engaged in this field. Includes a list of useful addresses, bibliography and glossary.

MARK, P. (1982) TT 4044

Introducing science as part of basic education: a case study in Trinidad and Tobago. Basic education for the real world. By the International Council on Education for Teaching. Washington, D.C.: ICET.

Prior to 1975, primary school science was taught as Nature Study and Hygiene in accordance with the 1956 syllabus. Following a 1977 survey of teachers attitudes to science and the identification of the cognitive development levels of primary school children, a science curriculum (SAPATT) was developed. At the Junior Secondary level the WISCIP curriculum is taught almost exclusively; teachers in the 5/7 year schools devise their own programmes. Three areas must be addressed to meet the demands of the new status accorded to science in the school curriculum: the science curriculum, the teachers and physical facilities in schools. At the primary level all three are being addressed; efforts at the Junior Secondary level are thwarted by the general policy for the recruitment of teachers for the secondary level and by the incohesiveness of the system at this level.

MITCHELMORE, J. (1984) JM 4045/703

Science Equipment in Jamaica: problems and directions. Paper presented at the Ministry of Education/Unesco Workshop on The Production of Science Equipment, Kingston, Jamaica, February.

MITCHELMORE, M.C. (1980) JM 4046/906

Three dimensional geometric drawing in three cultures. Educational Studies in Mathematics, 11(2), 205-216.

NICHTER, R. (1968) JM 4047/907

The curricula framework of general science program of junior secondary schools with recommendations for improvement - a report.

OWEN, M. (1973) BB 4048

ETV assists science curriculum development in Barbados. Educational Broadcasting International, 6 (December), 206-11.

Barbados inaugurated an ETV pilot project in 1970. At around the same time a West Indian Science Curriculum Innovation Project (WISCIP) sponsored by the Centre for Educational Development Overseas (CEDO) and The University of the West Indies, was adopted by the same schools in the ETV project. The article discusses how projects have co-operated to improve the quality of science education in Barbados with reference to the production and evaluation of programmes and difficulties encountered.

RAYMOND, E. (1978) BZ 4049

Environmental approach to primary science curricula - experience of an integrated day. Report of proceedings of the Regional Primary Science Conference, pp.105-108. [Cave Hill, Barbados]: Caribbean Regional Science Project.

The Rural Education and Agriculture Project (REAP) in Belize is an attempt to make rural primary education more relevant to the needs and life experience of children. One of its goals is to produce a curriculum which integrates rural environmental knowledge, skills and attitudes into existing curricula. REAP was organised and developed at a seminar/workshop by teachers of project schools in July 1977. Areas of study identified were: soils, plants, animals, weather, land/water, agricultural practices, village study, ecology and health/nutrition. Science related activities in each area of study are described.

RAYMOND, E. (1979) BZ 4050

Environemtnal approach - primary science curriculum Belize. Science education for progress: A Caribbean perspective, pp. 40-45. Edited by C.Lancaster and W.King. London: International Council of Associations for Science Education.

One of the goals of the Rural Education and Agricultural Project (REAP) is to produce a curriculum which integrates rural environmental knowledge, skills and attitudes in the existing curriculum to make it more relevant. Examples from Units of Activities found in Curriculum Guides at the Infant, Junior and Senior Primary levels, are given, followed by a description of science-related activities that can be found in the REAP curriculum.

RAYMOND, E. (1982) BZ 4051

A study of relationships of teachers' knowledge, attitudes and the degree of implementation of an innovative curriculum. Further details unavailable.

Investigates the relationships between teachers' knowledge and attitudes towards the principles of the REAP/LAPs and the degree of implementation. Teachers' knowledge and attitudes were also measured. Twenty-eight teachers from eleven rural primary schools, involved in the implementation of REAP/LAPs were used. Statistically significant correlations were found between: (a) teachers' knowledge of activity-based instruction and the degree of implementation; (b) teachers' knowledge of activity-based instruction and the integrated approach to teaching; (c) attitudes towards activity-based instruction and attitudes towards integration and (d) the degree of implementation of both principles of the REAP/LAPs. It was also found that teachers' knowledge of activity-based instruction was higher than knowledge of the integrated approach to teaching and the degree of implementation varied for each characteristic of the REAP/LAPs. The author recommends that: (1) the instruments used in this study be validated with a larger sample of teachers; (2) a longitudinal study be conducted to determine the changes in attitudes and the degree of implementation of the principles of REAP/LAPs among teachers; (3) an investigation be carried out to look at the philosophies and methodology of REAP/LAPs.

REAY, J.F. (1976) XI 4052

Diffusion of innovations in physics education into national systems. New trends in physics teaching, vol.3, pp. 142-151. Edited by J.L.Lewis. Paris: Unesco.

Briefly discusses the status of four physics curriculum projects (PSSC, Project Physics, Nuffield Physics and ISCS) and examines five stages in the successful diffusion of a curriculum. Concludes that while it may be better for a country to produce its own curriculum, it is wise to study the successes and failures of others. The need for continuous revision and diffusion is stressed.

REAY, J.F. (1977) XI 4053

Summative evaluation of Caribbean integrated science projects. New trends in integrated science teaching: Evaluation of integrated science education, Vol. IV, pp. 142-151. Edited by D.Cohen. Paris: Unesco.

Describes the combined evaluation of two concurrent curriculum development projects, the Mona Project of The University of the West Indies (UWI) in Jamaica and the CEDO/UWI Caribbean Regional Science Project based at UWI,

Barbados. The major strategy for summative evaluation was based on an educational experiment and upon achievement tests. There is little evidence that the data were used by decision-makers and it is suggested that, in the end, decisions are taken on the basis of availability of published materials and individual appraisal of these.

REAY, J.F. (1979) XI 4054

Strategies for the implementation of innovation in secondary science education in the Caribbean. Science education for progress: A Caribbean perspective, pp. 111-114. Edited by C.Lancaster and W. King. London: International Council of Associations for Science Education.

The responses of fifteen science educators from four Caribbean countries to a two-part questionnaire, inform this discussion of the function and value of teachers in curriculum development. The extent to which science teachers are influenced by curricula and the effectiveness of science teacher education are the concerns of a pilot teacher's questionnaire, also discussed.

REAY, J. (1982) XI 4055

Resources for science teaching: Report of a survey in the Commonwealth Caribbean. London: Commonwealth Secretariat.

The report discusses resources for school science education in Commonwealth Caribbean countries including Belize and Guyana. Included are: prototypes, models, experimental designs and mass production of equipment; improvisations; improvements on commercial equipment; science rooms; audio visual and printed resources; centres and information sources and servicing of equipment.

STEWARD, J.W. (1978) JM 4056/704

Science facilities and resources in Jamaican secondary schools. West Indian Science and Technology, 3(1), 19-22.

TAYLOR, B.J.T. (1986) BS 4057

Science curriculum development in the Bahamas - an overview. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 68-82. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Focuses on the development of the Primary Science Curriculum and its role as a prototype from which other science courses were patterned. The three-phased approach to curriculum development used, is detailed. Phase 1 involved an investigation of what was being taught in schools. In Phase 2, findings were analysed and trial

materials were drafted, tested, evaluated and revised. During Phase 3, the curriculum was implemented.

WALKER, E. (1978) XI 4058

Implications of primary science curriculum development on teachers' college programmes. Report of proceedings of the Regional Primary Science Conference, pp. 144-148. [Cave Hill, Barbados]: Caribbean Regional Science Project.

Discusses the implications of primary science curriculum development for training college programmes in science. Problems encountered at the training college are listed. The new role of the teacher, guidelines and standards for the training programme and areas for investigation are highlighted.

WALKER, T. (n.d.) LC 4059

The Belle-Vue low cost microscope. Produced at CANDU, St. Lucia. (Caribbean Regional Science Project Low-Cost Apparatus Handbooks).

A description of a low cost microscope.

WALKER, T. (n.d.) DM 4060

Dominica Science Project: low-cost apparatus: electricity construction modules for the classroom. Cave Hill, Barbados: School of Education, University of the West Indies.

WILLIAMS, I.W. (1973) TT 4061

WISCIP: A case study in curriculum innovation. s.l.:s.n.

Describes the establishment and first phase of the West Indian Science Curriculum Innovation Project (WISCIP) in Trinidad and Tobago. Adapted from the Scottish Integrated Scheme, the WISCIP scheme was a 3 year Junior Secondary science course consisting of fifteen units. Its objectives were to stimulate the development of the pupils' natural aptitudes and interests and to provide the pupil with some understanding of the nature of science and technology, and its relationship to the quality of life in modern society. The course developed three interrelated themes - Life, Materials and Energy - and included tests at the end of each unit and at the end of each year. Apart from formal testing, other forms of evaluation used were feedback from teachers and visits to schools.

WILLIAMS, I.W. (1979) XI 4062

The implementation of curricula adapted from Scottish integrated

science. Curriculum implementation and its relationship to curriculum development in science, pp. 295-299. Edited by P. Tamir et al. Jerusalem: Hebrew University, Israel Science Teaching Center.

The Scottish Integrated Science Curriculum (SIS) for Junior Secondary school classes, as well as its associated textbooks have been widely adopted in Scotland, the rest of the UK and in countries as far afield as Hong Kong, Lesotho and the Caribbean. The degree of adaptation varied widely. In the Caribbean, the scheme was presented in the form of lesson by lesson teachers' guides emphasising teaching methods, the organisation of practical work, questioning, discussion, consolidation and summary. Among positive conclusions which may be drawn from this mode of curriculum development are that practical science teaching exists where it did not before; and the science taught is more relevant to local conditions. On the negative side, the suitability of SIS for agriculturally-based developing countries is questionable, and the objectives claimed for Integrated Science generally have been over-ambitious.

WILSON, B. (1976) XI 4063

Caribbean mathematics. Mathematics in School, 5 (September).

Discusses the organisation of the Caribbean Mathematics Project, general procedures used in developing teaching materials, and teacher in-service training for the project.

WILSON, B. (1978) XI 4064

Change in mathematics education since the late 1950s: ideas and realisation: West Indies: curriculum development as a vehicle for in-service training: a study of secondary school mathematics in the Eastern Caribbean region 1970-1976. Educational Studies in Maths, 9 (August), 355-379.

Gives an account of the Caribbean Mathematics Project: its development, effects, successes and their limits, and failures and their causes. The project's major objective was to improve the skills of teachers by involving them in the processes of diagnostic testing and writing appropriate materials. Its achievements include a new awareness among teachers, the creation of tools for mathematics teaching, the introduction of new methods in the classroom and a new interest in mathematics. Unfortunately, it has had an inadequate impact on the teachers' college and the school system.

5.

ENVIRONMENTAL EDUCATION

Research in this area can be sub-divided into the following categories:

1. Problems in teaching environmental education;

2. Environmental knowledge and attitudes;

3. Teacher training;

4. Using environmental resources in teaching;

5. Overview of environmental education; and

6. Strategies for curriculum development.

BARNES, S. (1981) XI 5001

Urban environment/housing and safety in the Caribbean: the health education response. Paper presented at the Inter-American Symposium on Health Education, San Juan, Puerto Rico, May 31-June 4.

> The findings of a recent survey conducted by West Indian sanitary engineers highlight the undesirable aspects of sanitation, housing and safety in urban areas in the Caribbean. Caribbean health educators have begun to face up to these challenges and one example from Barbados is cited. The role of health education in tackling urban environmental problems is defined.

DUTTON, R. (1981) JM 5002/1101

Environmental education: A suggested strategy for Jamaica. Caribbean Journal of Education, 7(1), 43-63.

EVANS, S. (1983) JM 5003/1102

An analysis of Jamaican students' environmental knowledge, attitudes and activities at a sixth grade level in rural and urban communities. Unpublished M.A. thesis, University of the West Indies, Jamaica.

GLASGOW, J. L. (1979) JM 5004/1103

Teaching with your environment in mind. Paper presented at the Annual Conference of the Association of Science Teachers of Jamaica.

GLASGOW, J.L. (1980) JM 5005/1104

Strategies for the training of teachers in environmental education for primary and secondary schools and teacher education institutions. Paper prepared for the Sub-regional Training Workshop on Environmental Education for the Caribbean, Antigua, June 9 - 20.

GLASGOW, J.L. (1981) JM 5006/1105

The educational implications of using environmental resources. Paper presented at the Annual Conference of the Association of Science Teachers of Jamaica.

GLASGOW, J.L. (1985) JM 5007/1106

Preliminary directory of some environmental education activities in Jamaica. Unpublished paper. Mona, Jamaica: University of the West Indies.

GLASGOW, J.L., (1987) XI 5008/1107

Syllabuses with an environmental emphasis in the Caribbean. Caribbean Curriculum, 2, (1), in press.

GLASGOW, J.L. ed. (1983) XI 5009/1108

Final report, Sub-regional Workshop on Teacher Training in Environmental Education for the Caribbean. Mona, Jamaica: School of Education, University of the West Indies.

GLASGOW, J.L. and ROBINSON, P. (1983) JM 5010

Environmental education: Module for pre-service training of teachers and supervisors for primary schools. Paris: Unesco. (Environmental Education Series, 5). Docoment ED83/WS/91-11.

GRIFFITH, S. and WILLIAMS, E. (1982) BB 5011

Environmental education manual: teacher's guide to environmental education. Bridgetown, Barbados: Caribbean Conservation Association; Columbus, Ohio: Ohio State University.

> Draft intended for use as a guide to the teaching of environmental education in upper secondary schools in Barbados. Consists of five units covering the following topics: the environment and environmental conservation, soil erosion and conservation, land use and misuse, wildlife, vegetation; water pollution and management, air pollution, the marine ecosystem; and natural disasters and their effect on the environment and looking ahead. Each unit is prefaced by an introductory statement, general objectives and list of references. Lesson plans suggest specific objectives, learning activities, assignments and methods for evaluation.

HALL, D.R. (1985) CR 5012

Environmental education in Costa Rica. Prospects, 15 (4), 583-591.

The current Environmental Education Programme reflects a deliberate attempt to introduce the environmental approach into formal education curricula in Costa Rica. This article traces the background to the programme and outlines its goals, organisation, scope, coverage and teaching methods, and indicates results obtained and difficulties experienced.

HAMILTON, M.A. (1980) JM 5013/1110

Strategies for curriculum and materials development in environmental education for primary and secondary schools and teacher education institutions (a Jamaican perspective). Working paper prepared for the Sub-regional Training Workshop on Environmental Education for the Caribbean, Antigua, June 9 - 20.

JAMES, C.A. (1984) XI 5014

Environmental education and public awareness in the wider Caribbean: an overview. Paper presented at the Conference of the North American Association of Environmental Education, Lake Louise, Alberta, Canada, 5-9 October.

Describes the project on environmental education and public awareness in the wider Caribbean, a UNEP project which is being implemented by the Caribbean Conservation Association. Phase 1 consisted of a survey of environmental activities in the region. During Phase 2, public awareness material for circulation to the mass media, was produced. The project is about to enter its third phase, during which activities of the project are to be consolidated.

JIMENEZ, J.C. (1983) PR 5015

An educational approach to create an awareness and understanding of the marine mammals that inhabit the waters of Puerto Rico. Unpublished Ed.D. dissertation, University of Massachusetts, U.S.A.

The study seeks to develop a better public understanding of the marine mammal population, determine the distribution and abundance of marine mammals in the area and train students, fishermen and volunteers to assist in the research. Surface and aerial censuses were taken of manatees and whales, and fishermen and volunteers were trained to help with the sightings. Findings were disseminated via lectures, workshop exhibits and the media; a network of volunteers was initiated as a result.

LAURENT, E.C. (1985) TT 5016

Environmental issues in the Caribbean - an educational approach to tackle them. Paper presented at International Conference on Environmental Education, New Delhi, India, 4-9 March.

The paper examines the geographical and historical nature of the islands and the factors which contribute to environmental problems. At present, environmental education programmes in the Caribbean are problem-oriented because of the need to influence attitudes of various segments of society. Topics are integrated into the established social studies curriculum. An approach to solid waste management through environmental education in Trinidad and Tobago, is discussed.

WILLIAMS, R.A. (1976) XI 5017

Environmental education in schools. Social Studies Education, 8 (October), 11-16.

Provides reference notes on the environment in the hope of encouraging more environmental education in schools. Topics covered are: man and his environment, modern environmental conservation, environmental pollution, a National Environmental Action Programme, and the school and the environment.

6.

SCIENCE ACHIEVEMENT/ORIENTATION

Research in these areas can be sub-divided into the following sections:-

1. Student performance at primary, secondary and tertiary levels;

2. Factors affecting achievement at primary, secondary and tertiary levels;

3. Factors associated with science orientation;

4. The effect of certain teaching strategies on achievement.

ALFRED, J.M. and NOEL, S.(1980) TT 6001

The Cambridge GCE Advanced Level in chemistry, June 1979: An analysis of candidate performance in Port-of-Spain schools and of the examination papers. Journal of Education in Science for Trinidad and Tobago, 7, (May), 5-10.

> Out of the 204 candidates from the eight schools examined, 'O'level grades were available for only 199. Just under 75% of the sample had 'O' level chemistry grades below A. The best overall performance occurred in Paper 3, with 62.3% obtaining the passing Grade 6 or higher; candidate. performance was weakest on Paper 4. The evaluation of 1978 and 1979 results suggests that there is a relationship between performance in 'O' level chemistry and that of 'A' level chemistry. A relationship was found between the study of mathematics for 'A' level and performance in 'A' level chemistry. If this relationship is causal, mathematics/ science interaction needs attention.

BERRIOS, J.E. (1970) PR 600?

The effects of departmentalization on achievement in reading and arithmetic on fourth grade pupils in public schools of Puerto Rico. Unpublished Ed.D. dissertation, Leigh University, U.S.A.

> Investigates the effects of the departmental type of organisation for instruction on achievement in arithmetic and reading of 4th grade pupils; and determines the difference in the preference of the pupils and teachers of rural and urban schools, for the self-contained classroom or departmental type of school organisation. Each of the sixteen classes studied was divided into above average, average and below average ability groups. The mean gain score for each group in each of the classes was then computed. The mean gain scores in reading and arithmetic

was subjected to a two-way analysis of variance. Data related to student and teacher preferences were obtained by a questionnaire.

BROOMES, D.R. (1971) XI 6003

Psychological and sociological correlates of mathematics ability and achievement. Unpublished Ph.D. dissertation, University of Toronto, Canada. Abstract unlocated.

BROOMES, D.R. (1972) XI 6004

Comparison of mathematics achievement of students in five teachers' colleges in 1967 and 1971. Cave Hill, Barbados: Institute of Education, University of the West Indies.

BROOMES, D.R. (1972) XI 6005

Statistical analyses of final year mathematics examination (1971) in six teachers' colleges of the Eastern Caribbean. Cave Hill, Barbados: Institute of Education, University of the West Indies.

Performance of candidates on Mathematics - Part 1 of the Final Year Mathematics Examination (1971) held in teachers' colleges in Antigua, Barbados, Grenada, St. Kitts, St. Lucia and St. Vincent, is presented and statistically analysed. Detailed analyses of performance on each item of the test showing the number of candidates (male and female) in each college who got the item correct or wrong, or who omitted it, are also presented. Some uses for the taxonomy of mathematical objectives and item analysis are suggested.

BROOMES, D.R. (1972) BB 6006

A study of the mathematics achievement of first year and second year students at Erdiston Teachers' College, January 1972. Cave Hill, Barbados: Institute of Education, University of the West Indies.

BUJAN-DELGADO, V.M. (1982) CR 6007

A study of the relationships between socio-economic characteristics and aspects of mathematical achievement of primary school children of grades four and six in Costa Rica. Unpublished Ph.D. dissertation, Ohio State University, U.S.A.

The findings of this study of 1175 Costa Rican school children suggest that: students of high socio-economic status (SES) perform better than students of low SES, in arithmetic problem-solving when solving one-step problems with or without extraneous information; students from the province of San Jose perform better than students from the rest of the country when solving arithmetic word problems; and the ability of Costa Rican fourth and sixth graders to

solve arithmetic problem is not significantly higher than that of 9 year-old American school children.

CARTY, L. (1986) KN 6008

An exploratory study of relationships among learning styles, students' perceptions of the Biology Department and academic achievement in biology. Unpublished B.Ed. dissertation, University of the West Indies, Barbados.

Examines the learning process of 109 biology students of the Basseterre Senior High School, St. Kitts-Nevis. Data were obtained by means of the Learning Strategies Inventory, Course Perceptions Questionnaire and Biology Achievement Test. Analysis of the data shows that 'versatile' learners tend to perform well in biology as opposed to 'comprehension' or 'operation' learners who perform poorly; study strategies and approaches are not significantly related to achievement; and performance is best explained by good teaching, achievement orientation, workload, versatile learning, clear goals and standards.

CURBELLO, J. (1986) PR 6009

The effects of teaching problem-solving on students' achievement in science and mathematics: a meta-analysis of findings. Science education and cultural environments in the Americas: A report of the Inter-American Seminar on Science Education, pp. 77-78. Edited by J.J. Gallagher and G. Dawson. Washington, D.C.: National Science Teachers Association.

Summary report based on author's Ph.D. thesis completed at Florida State University. Of 128 studies written during 1967-1984, sixty eight were selected for meta-analysis. The latter revealed that achievement of groups of students given instruction in problem-solving, exceeded that of students not receiving instruction by an average of .54 standard deviations; duration of instruction is positively correlated with performance on problem-solving measures; the most effective duration of instruction in problem-solving appears to be five to ten weeks; problem-solving can be taught effectively in any academic topical area in science and mathematics; and the inquiry method is one of the most effective strategies for teaching problem-solving.

DE PASARELL, C.L.(1970) PR 6010

A study to determine the effect of kindergarten experience on the achievement of students in mathematics and spanish in the first, second and third grades in a selected public school in Puerto Rico. Ed.D. dissertation, New York University, U.S.A.

Standardised mental capacity and achievement tests in mathematics, reading-readiness and basic skills in Spanish were administered to two groups of each grade (1,2,3),

matched on the basis of participation and non-participation in the kindergarten programme. Results were compared to teachers' final grade in each subject to determine the degree of correlation between them. A pre- and post- collective Puerto Rican Test of Mental Capacity, was administered at the beginning and end of the study to determine possible differences in the variable of ability between groups of the same grade. The study concludes that there is need for improvement of teachers evaluative measures, extensions of the public kindergarten programmes and establishment of district evaluation centres.

FURLONGE, E.A. and MACDONALD, T.L. (1972) TT 6011

An interim report on the mathematics achievement of first-year trainees at the teachers' colleges in Trinidad and Tobago. St. Augustine, Trinidad: Institute of Education, University of the West Indies.

Prior to developing the mathematics curriculum for the teachers' colleges in Trinidad and Tobago, Mathematics Test A was administered at the beginning of the academic year 1971-72 to 338 first year teacher trainees in five of the six teachers' colleges. Data on the population and results of the test are presented in tabular format. The majority of trainees (146) had attained a Teacher Certificate. The average number of correct answers was 32, of incorrect answers, 26; and the average not attempted was 27.

GEORGE, J.M. and NOEL, S. (1981) TT 6012

The Cambridge GCE examination in chemistry advanced level, June 1980: an analysis of examination papers and student performance in schools in Trinidad and Tobago. Journal of Education in Science for Trinidad and Tobago, 9 (October), 1-7.

Trends emerging in the present study (Port-of-Spain and island-wide) are the same as those observed in 1978 and 1979 (Port-of-Spain only). More than 50% of candidates writing A-level chemistry obtained a Grade B at 'O' level. The best results at 'A' level were obtained by candidates scoring a Grade A at 'O' level; over 85% of the candidates obtaining a Grade A at 'O' level, passed at 'A' level. The standard of performance in Paper 1 was unusually low and performance in the practical examination still leaves much to be desired.

HALLIDAY, J.A. and ROSE, G. ST.C. (1986) XI 6013

Error analysis of candidates responses to select questions on CXC 1985 Basic Proficiency Mathematics paper II examination - a preliminary investigation. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp. 201-218. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Responses to five questions in a sample of 270 scripts from Barbados, Trinidad and St. Kitts, were analysed by fifteen experienced examiners, who were required to identify and describe the errors made. The latter were classified by the investigators using an error classification scheme adapted from Radatz. The study found that 37.8% of errors were due to candidates' inability to map out a strategy for solving the problem; 30.9% were due to lack of pre-requisite skills; 46.3% were due to reading, comprehension and transformation skills; algebra errors were numerous. Eight recommendations are listed.

HAMILTON, M.A. (1976) JM 6014/201

A study of certain personality, educational and environmental variables associated with science orientation, in a selected group of fifth form students. Unpublished Ph.D. dissertation, University of the West Indies, Jamaica.

HAMILTON, M.A. (1976) JM 6015/202

A study of certain personality, educational and environmental variables associated with science orientation, in a selected group of fifth form students in secondary schools in Jamaica. Caribbean Journal of Education, 3(3), 227-243.

HAMILTON, M.A. (circa 1979) JM 6016/203

The practising Jamaican scientist - a profile. West Indian Science and Technology, 4(1), 17-22.

HAMILTON, M.A. (1985) JM 6017/204

Performance levels in science and other subjects for Jamaican adolescents attending single-sex and co-educational high schools. Science Education, 69, (July), 535-547.

ISAACS, I.A. (1974) JM 6018/205

Some factors related to the performance in mathematics of third year students in Jamaican post-primary schools. Unpublished M.A. dissertation, University of the West Indies, Jamaica.

ISAACS, I.A. (1975) JM 6019/206

The mathematical performance of a selected sample of third year students in Jamaican post-primary schools. Caribbean Journal of Education, 2(1), 15-23.

ISAACS, I.A. (1976) JM 6020/207

Environmental and other factors affecting the performance in mathematics of third year students in Jamaican post-primary schools. Caribbean Journal of Education, 3(1), 51-65.

JAMAICA. MINISTRY OF EDUCATION.
RESEARCH SECTION (1985) JM 6021/208

Mathematics competence of grade 7 students from all-age schools. Research Bulletin, (July).

JIMENEZ, M.A. (1983) PR 6022

A study of the effects of certain variables upon 4th and 6th grade Costa Rican children's ability to solve arithmetic word problems. Unpublished Ph.D. dissertation, Ohio State University, U.S.A.

> Investigates the relationships between ability to solve arithmetic word problems and the following variables: length of the problem statement, presence or absence of extraneous information, reading ability and computation ability. Seven hundred and ninety five children from thirty schools participated in the study for which three instruments were designed: the arithmetic word problem test, close test and computation test. Findings suggest that private school students perform better on problem-solving than urban and rural students; sixth graders perform better than fourth graders; students perform better on prose format than on short format problems; and many students are unable to apply familiar computations to problem situations.

LEO-RHYNIE, E.A. (1978) JM 6023/209

An investigation into the relationship of certain cognitive, environmental, and academic achievement of selected Jamaican sixth form students. Unpublished Ph.D. thesis, University of the West Indies, Jamaica.

LEO-RHYNIE, E.A. (1978) JM 6024/210

The performance of Jamaican sixth form students in the Cambridge 'A' level examinations. Caribbean Journal of Education, 5(3), 153-167.

LESTCH, M.E. (1984) PR 6025

Cognitive style as a factor in the mathematics achievement of mainland Puerto Rican children. Unpublished Ph.D. dissertation, Fordham University, U.S.A.

> Investigates the relationship of overt and covert material control to the cognitive style and mathematics achievement of one hundred and fifty eight urban mainland Puerto Rican children. The study fails to support Witkin's contention that individual differences in field dependence-independence are related to culturally-based and gender-specific differences in child-rearing practices which foster or limit autonomy in the child. Neither do the results support the contention that the positive relationship found between the

greater field dependence of certain Hispanic children and their low mathematics achievement is, in turn, related to specific cultural emphases in child-rearing and values.

LOGIE, C. (1985) TT 6026

School effectiveness: Case studies of four elementary schools in Trinidad. Unpublished M.A.(Ed.) dissertation, McGill University, Canada.

Five selected in-school variables associated with student achievement in industrialised countries were examined within four effective elementary schools in Trinidad. The study variables included: (1) school resources, (2) the role of the principal, (3) school policies, (4) student concept of ability and (5) academic press. Exploratory case studies which utilised observational techniques, interviews and questionnaires, were examined. A variety of data which illustrated these school characteristics were collected. Despite great differences in the amount of resources typically found in North American schools, the findings were not unlike those found in the research from industrialised countries. The study found that variables which are associated with effective schools in industrialised nations also played an important role in the Trinidadian schools studied. The role of the principal, school policies, student concept of ability and academic press were found to be critical variables within the schools studied. The study suggests further research is needed in order to fully understand the context of school effectiveness in developing countries.

LUNA, E., GONZALES, S. and YUNEN, R. (1986) DO 6027

Brief description of the study "the teaching and learning of mathematics in the Dominican Republic". Science education and cultural environments in the Americas: report of an Inter-American Seminar on Science Education, pp. 66-76. Edited by J.J. Gallagher and G. Dawson. Washington, D.C.: National Science Teachers Association.

Describes the methodology of a national study regarding the teaching and learning of mathematics in grade 8 in public and private schools in the Dominican Republic. Over fifty thousand students in approximately one thousand schools in both rural and urban areas were tested. Curriculum objectives and content were first analysed using the IEA International Mathematics Committee's Table of Specifications. Data on instructional methods and classroom practices were obtained through questionnaires answered by principals and teachers. Student achievement was measured by means of multiple choice tests covering significant aspects of the mathematics curriculum. Background data on students were also solicited by means of a questionnaire. Mathematics anxiety and sex stereotyping were also measured.

MEDFORD, R. (1974) XI 6028

The importance of structure in the teaching of mathematics with special reference to multiplication, Caribbean Journal of Education, 9, (June), 64-65.

A pictorial test was administered to pupils of the 7-8 age range, to see whether they could read and write a numeral and identify the units and 'tens' places in it. This was followed by a course of five lessons, emphasising place value of the numeration system and the distributive property of multiplication. Results of an achievement test suggest four principles to be observed when teaching mathematics.

MITCHELMORE, M.C. (1974) JM 6029/211

The perceptual development of Jamaican students, with special reference to visualization and drawing of three-dimensional geometrical figures and the effects of spatial training. Unpublished Ph.D. dissertation, Ohio State University, U.S.A.

MITCHELMORE, M.C. (1982) JM 6030/212

The Cooperative Geometry Research Project. Mona, Jamaica: School of Education, University of the West Indies.

MOHAN-RAM, V. (1977) XI 6031

Mathematics performance of student teachers in five teachers' colleges in the Eastern Caribbean territories over the period 1967-1976. Mathematics News Caribbean Maths Bulletin, 2,(1).

The mathematics performance of student teachers in their final maths examination over a ten year period was compared. The data showed that: (i) the general performance of the student teachers decreased each year; (ii) the level of difficulty on each item remained the same in each successive year and (iii) the mathematics performance of the female student teachers on these items was consistently below that of the male teachers.

NOEL, S. and ALFRED, J.M. (1979) TT 6032

A preliminary evaluation of the Cambridge GCE examination in chemistry - advanced level - June 1978. Journal of Education in Science for Trinidad and Tobago, 6, (May), 9-11, 34.

Of the one hundred and eighty-nine students from the eight schools examined, forty-two obtained Grade A in the 'O' level examination. Of these 92.9% were successful at 'A' level; 50% of the students obtaining Grade B at the 'O' level, passed at 'A' level. The distribution of grades obtained in the four examination papers is discussed. The majority of students in the sample seemed unable to perform

the skills being tested. Chemistry teachers might find it helpful to investigate whether teaching provides students with the opportunities for developing these abilities and also to examine the criteria used for selecting 'A' level chemistry students.

PARRIS, D.J. (1981) JM 6033/213

An investigation into the relationship of certain variables to the science achievement of a selected group of Jamaican fifth form students. Unpublished M.Ed. dissertation, University of the West Indies, Jamaica.

PHILLIPS, W. (1974) BB 6034

The cognitive processes underlying certain classes of mathematical problems. Caribbean Journal of Education, 1 (June), 66-72.

To identify computational abilities and skills of pupils, a test was administered to thirty-six form 1 pupils. Forty-one problems utilizing the computation skills pupils possessed were selected and administered as a test. Performance was low. Lessons designed to help pupils solve mathematical problems were taught to the experimental group and the second test was re-administered. Results indicate a slightly better mean performance in all four arithmetic operations, for boys than for girls; for both boys and girls mean performance in division was weak.

QUINTERO, A.H. (1984) PR 6035

Children's difficulties with two-step word problems. Paper presented at the 68th Meeting of the American Educational Research Association, New Orleans, April 23-24.

Seventy-one fifth grade children in Puerto Rico were individually observed solving five problems: two 2-step problems and three 1-step problems with the same mathematical structures as the 2-step problems. The majority of children (66.6%) had difficulties with the two-step problems due to: lack of understanding of the concepts and relationships involved; incorrect strategy for working any word problem; using one instead of two operations to solve the problem; and a mismatch between order of presentation and order of operation.

RADCLIFFE, C.A. (1980) XI 6036

The relative effectiveness of the guided discovery and expository methods of teaching on mathematics achievement on three taxonomic levels. Unpublished M.Ed. dissertation, University of the West Indies, Jamaica.

The study investigates the relative effects of the guided

discovery and expository teaching methods on the performance of students at the recall, algorithmic thinking, and problem-solving taxonomic levels. The results indicate that: (1) the high ability students performed significantly better than low ability students; (2) there were no significant differences between methods on overall performance or at any of the three taxonomic levels; (3) there was no significant interaction between ability level and teaching method, on overall performance at the three taxonomic levels.

REID, L.H.E. (1964) JM 6037

The effects of family pattern, length of schooling and other environmental factors on English and basic arithmetical attainments of Jamaican primary school children. Unpublished Ph.D. dissertation, University of London, England. Abstract unlocated.

ROACH, D.A. (1978) JM 6038/214

The effect of cognitive style and other related variables on the achievement in mathematics of some Jamaican elementary school children. Unpublished Ph.D. dissertation, University of the West Indies, Jamaica.

ROACH, D.A. (1979) JM 6039/215

The effects of conceptual style preference, related cognitive variables and sex on achievement in mathematics. British Journal of Educational Psychology, 49, (February), 79-82.

ROACH, D.A. (1981) JM 6040/216

Predictors of mathematics achievement in Jamaican elementary school children. Perceptual and Motor Skills, 52 (June), 785-6.

SAN MIGUEL, E.A. (1983) PR 6041

An analysis of the relationship between the principal's cognitive style, school organizational climate and pupil achievement in Puerto Rico. Unpublished Ed.D. dissertation, State University of New York at Buffalo, U.S.A.

Addresses the following questions: Is school location associated with principal's cognitive style, school socio-economic status and principal's length of time in school? Is pupil achievement directly associated with socio-economic status? Is principal's length of service in the school associated with pupil achievement, school organisational climate, and with principal's cognitive style? Eight urban

and eight rural secondary schools were selected at random from the two educational regions, selected on the basis of high or low achievement. Instruments used were the Belief System Instrument, Profile of a School, and Report of Pupil Achievement in Math.

SEATON, H.C. (1980) JM 6042/217

The relationship of selected motivational variables to the 'A' level science achievement of Jamaican students. Unpublished M.A. Thesis, University of the West Indies, Jamaica.

SHAH, S.A. (1967) TT 6043

An experiment: reactions of some children age range 7-11 years, to certain aspects of 'Modern Geometry'. St. Augustine, Trinidad: Institute of Education, University of the West Indies. Mimeo.

Eleven student-teachers attending a teachers' college in Trinidad, tried a series of lessons on "Modern Geometry" with their practising class during three weeks of their teaching practice session. The reactions of a sample of children were obtained through an objective test which was standardised with the same sample. The responses obtained indicated that attainment was of a reasonably high level.

SHAH, S.A. (1968) TT 6044

An experiment: reactions of some children age range 7-9+, and 10+-11+ years to certain aspects of sets. St. Augustine, Trinidad: Institute of Education, University of the West Indies. Mimeo.

Seventeen teachers of the "Lower" Juniors and sixteen teachers of the "Upper" Juniors attending a teachers' college in Trinidad, tried a series of lessons on "sets" with their practising class, during three weeks of their teaching practice session. The reactions of a sample of children were obtained through an objective test which was standardised with the sample. The responses obtained indicated that attainment was satisfactory.

SHAH, S.A. (1968) TT 6045

An experiment: reactions of some children age 7-9 plus years, to certain aspects of 'number systems' which were taught by using some psychological principles. St. Augustine, Trinidad: Institute of Education, University of the West Indies. Mimeo.

To study the application of five psychological principles to the teaching of number systems, ten student-teachers conducted a series of lessons on number systems, with three hundred and fifty four 7-9 year-old pupils, over a period of three weeks. A forty-item objective test was administered

to pupils to determine their reactions towards the content discussed. Concludes that attainment was of a reasonable level.

SHAH, S.A. (1969) TT 6046

Selected geometric concepts taught to children ages seven to eleven. Arithmetic Teacher, 16 (February), 119-128.

Eleven student teachers in their second year of a two year professional programme at a teachers college in Trinidad, taught a series of lessons on 'modern geometry' over a period of two weeks to children aged seven to eleven. An objective test of the content, standardised with the same content was then given. Performance on the test indicated a reasonably high level of attainment.

SQUIRES, S. (1974) BB 6047

The importance of the common fraction in the primary school. Caribbean Journal of Education, 1, (June), 58-63.

Describes a study which investigated fractions used in everyday life, people's perceptions of what fractions should be taught in schools and the abilities of 9-11 year-old pupils to do fractions. The two instruments used were a questionnaire distributed to groups of people in various occupations; and a mathematics test administered to 9-11 year old pupils. The findings suggest that more emphasis should be placed on the teaching of common fractions in primary schools; older pupils perform better than younger pupils; and word problems requiring pupils to use more than one arithmetic operation were found to be very difficult.

TAYLOR, A. (1984) MS 6048

The effect of advance organizers and Brunerian sequencing on students acquisition in science. Unpublished B.Ed dissertation, University of the West Indies, Barbados.

Forty first year students at the Plymouth Junior Secondary school were randomly assigned to 4 treatment groups and exposed to 8 hours of instruction over a two week period. Students were pre-tested to determine pre-experimental knowledge about the topic of instruction and post-tested to measure acquisition. Results indicate that advance organisers and Brunerian sequencing had no mean effect on overall acquisition in science; advance organisers had no mean effect on knowledge and comprehension abilities but enhanced students' acquisition of the higher order ability; and advance organisers and/or Brunerian sequencing had no differential effect on students' acquisition of a science unit on energy.

WHARTON, A.E.B. (1984) TT 6049

Comparative studies of student performance in physics and in other science subjects over a six year period. Proceedings of the Second Caribbean Conference in Physics, pp. 144-159. Edited by L.L. Moseley. Cave Hill, Barbados. Department of Physics, University of the West Indies.

> Analyses examination marks of students in the Faculty of Natural Sciences, U.W.I., St. Augustine to determine the magnitudes of systemic differences between courses in the first year and in the final year of the B.Sc General Degree programme. The period used is from 1978 to 1983. Most subjects are found to be reasonably close to faculty norm, but year 1 mathematics is 7 marks too low and year 1 computer science 13 marks too high. In an extreme case, a teacher could account for a deviation from the norm of 15 marks. Computer adjustment of marks is not recommended.

WHITE, A.L., BERLIN, D.F. and FRASER-ABDER, P. (1987) TT 6050

The use of concrete, manipulative materials and computer simulations for learning elementary school science process skills in Trinidad and Tobago. Paper presented at the 60th National Association for Research in Science Teaching Conference, Washington, D.C., April 23-25.

> Suggests that learning progresses along a mode of representation continuum from concrete to semi-concrete to abstract, translated into instructional practice as manipulation of physical objects, pictorial or graphic representation, and finally symbolic form. To determine the optimum combination of science process learning activities for elementary school children in Trinidad and Tobago, three treatment conditions were given to a sample of twenty-eight boys and thirty eight girls, aged 6-9: computer only, manipulatives and computer and manipulatives only. Findings indicate no differential effects between the use of manipulative materials and the computer; a greater difference between scores of 2nd and 4th grade girls than between those of 2nd and 4th grade boys; 4th grade scores were significantly higher than 2nd grade scores on both Design Recognition and Patterns scales.

7.

SCIENCE ATTITUDES

Studies in this area included:

1. Attitudes to science, integrated science and women in science;

2. Factors affecting attitudes to science and mathematics;

3. Relations between attitude and achievement, attitude and gender and attitude and teaching methods;

4. Development of attitude scales;

5. Teacher attitude to science and science education.

ALLSOP, R.T. and HASSANALI, A. (1982) TT 7001

Integrated science - what do teachers think? Journal of Education in Science for Trinidad and Tobago, 10 (October), 1-6.

> Summarises the findings of a study on teachers' attitudes towards integrated science in Trinidad and Tobago. Full details of the study are recorded in Hassanali's M.Sc. thesis (1982).

COLON COLON, J. (1982) PR 7002

An investigation of the effects of migration on self-concept, attitude toward mathematics and achievement in mathematics among Puerto Rican return-migrant students and Puerto Rican students who have never migrated. Unpublished D.Ed. dissertation, Pennsylvania State University, U.S.A.

> One hundred and fifty return-migrant students and two hundred and sixty six students who have never migrated were administered the Piers-Harris Children's Self-Concept Scale, the Suydam-Trueblood Attitudes Toward Mathematics Scale, the Cultural Adjustment Scale, the Coopersmith Self-Esteem Inventory and a measure of the perception of social environment. Mathematics achievement scores were obtained and multiple linear regression analysis was used to determine the possible predictive values of self-concept, attitudes toward mathematics and cultural adjustment on mathematics achievement.

ESQUIVEL, J.M.(1987) CR 7003

Costa Rican teachers' attitude toward science and science teaching and its relationship to selected variables. Paper presented at the 60th National Association for Research in Science Teaching Conference, Washington, D.C., April 23-25.

An 80-item Likert-type inventory was administered to one hundred and thirteen elementary teachers and one hundred and fifteen secondary science teachers in Costa Rica, to measure attitudes to science and science teaching. Results indicated that elementary school teachers significantly differ from secondary science teachers in their attitude as measured by four of the eight scales of the inventory. In general, however, attitudes were positive for both groups of teachers. No gender differences were found; however, there were regional differences and differences between tenured and non-tenured teachers of secondary science and significant differences in favour of non-degreed elementary teachers.

FRASER-ABDER, P. (1984) TT 7004

The effect of participation in an activity-oriented science curriculum development workshop on the attitude of elementary teacher in Trinidad and Tobago. Paper presented at the 57th National Association for Research in Science Teaching Conference, New Orleans, U.S.A., April.

Investigates the extent of attitudinal change towards the teaching of science, in thirty-five elementary teachers during a science curriculum development workshop. The model used attempts to incorporate some aspects of science content development, manipulative hands-on experiences, video-taping, development of self-confidence, teach-reteach methodology and supervisor, peer and self-evaluation strategies; and to modify the teacher's effective, cognitive and behavioral responses to science teaching. Results obtained from a 27-item instrument indicate development of positive attitudes in four areas measured, demonstrating the effectiveness of the model.

FRASER-ABDER, P. and SHRIGLEY, R.L. (1980) TT 7005

A status study of the science attitudes of elementary school teachers in Trinidad and Tobago. Science Education, 64, (October), 637-44.

The science attitude scale for in-service elementary teachers was administered to science teachers at six teachers training colleges to test the effect of the following variables on science attitude: gender difference, age level taught, type of school, geographic location,

mathematics and science courses taken. Results show that male teachers have a more positive attitude toward science and science teaching than female teachers; age level which student teachers choose to teach, may have some effect on their attitude and teachers with elementary and secondary science education have higher attitude scale scores than teachers with only elementary education or none at all.

HAMILTON, M.A. (1978) JM 7006/301

The scientific attitudes of high school students - a short study. Journal of Education in Science for Trinidad and Tobago, 5(3), 18-24.

HAMILTON, M.A. (1980) JM 7007/302

Attitude and achievement - Is there a link? Journal of Education in Science for Trinidad and Tobago, 7(3), 1-4.

HAMILTON, M.A. (1982) JM 7008/303

Jamaican students' attitude to science as it relates to achievement in external examinations. Science Education, 66, (April), 155-169.

HAMILTON, M.A. (1983) JM 7009/304

Preliminary work on the development of a science attitude scale for Jamaican high school students. Caribbean Journal of Education, 10(1), 18-22.

HAMILTON, M.A. (1985) JM 7010/305

The attitudes of older Jamaican adolescents to 'Women in Science', Unpublished paper. Mona, Jamaica: Faculty of Education, University of the West Indies.

HAMILTON, M.A. (1986) JM 7011/306

Scientific attitudes - some considerations for teachers. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

HASSANALI, A. (1982) TT 7012

Teachers attitudes to the introduction of integrated science in the fourth year of secondary school in Trinidad and Tobago. Unpublished M.Sc. dissertation, University of Oxford, England.

A 30-item, Likert-type attitude scale was constructed and sent to a sample of two hundred and twenty science teachers in fifty seven government or government-assisted secondary schools in Trinidad and Tobago. Teachers were asked to respond to each statement considering the Less Able pupil

separately from the More Able pupil. One hundred and thirty one teachers responded. The study shows that four main factors contribute to teachers' attitudes: acceptance of integrated science; the challenge of teaching integrated science; staff support, preparation and commitment; and the coherence of science. Further, trained teachers and chemistry teachers were more in favour of integrated science than untrained teachers and biology teachers, respectively. In general, teachers held more favourable attitudes for the Less Able pupils than for the More Able pupils.

LANCASTER, C.M. (n.d.) XI 7013

Opinions on science education in the Caribbean. Cave Hill, Barbados: School of Education, University of the West Indies.

A battery of attitude assessments was administered to a group of student teachers and a group of practising teachers The tests reviewed aims of primary education, constraints imposed, attitudes towards stating aims, child-centredness and innovation, and attitudes to science education. Students rated 'intellectual capabilities' most highly as the aim of primary education, while practising teachers emphasised 'practical skills'. Students rated the level of general leadership within the school as the most important constraint inhibiting ideal performance; practising teachers emphasised the level of provision of in-service training. Respondents agreed that there was a need for a set of aims and a highly structured programme of science; there was a divergence of opinion as to the need for teaching the facts and concepts of science to children, with the students more strong in their agreement.

STEPHENSON, L. and MITCHELMORE, M.C. (1982) JM 7014/307

The relationship between lecturers' teaching methods and students' attitudes to mathematics in Jamaican teachers' colleges. Caribbean Journal of Education, 6(2), 159-173.

8.

NUTRITION/HEALTH EDUCATION

Publications in this area included:

1. Overview;

2. Status, development and implementation of nutrition/health education programmes;

3. Nutrition/health education curriculum development, implementation and evaluation;

4. The teaching of nutrition and health;

5. Teaching strategies.

ANTROBUS, A.C.K. (1977) XI 8001

The challenge of nutrition education in the Caribbean. Cajanus, 10, (1977), 22-31.

> Key problems to be faced by nutrition educators in the Caribbean are: promotion of breastfeeding, increasing reliance on local products; better use of family food resources, improving hygiene, and developing a better monitoring system for mothers and their children. Nutrition education, especially through mass media campaigns, will play a key role and the development of suitable materials should be a high priority.

BERNARD, J.A. (1979) TT 8002

Factors influencing the establishing of schools of allied health professions - Trinidad and Tobago. Unpublished Ph.D. dissertation, University of Pittsburgh, U.S.A. Abstract unlocated.

CARIBBEAN FOOD AND NUTRITION INSTITUTE (1978) XI 8003

The use of mass media in food and nutrition programmes: guidelines for planners and decision-makers. Kingston, Jamaica: Caribbean Food and Nutrition Institute.

> Presents concise guidelines on problem identification, co-ordination of programme planning, problem analysis, formulation of objectives, identification of audience characteristics, message design, media selection, research and evaluation of nutrition programmes. Includes lists of training and research needs, proposals for action and reports on recent nutrition education development activities in the region.

DeJONG, W., FELT, W., HOLLIS, C.,
ISREAL, R., MASON, G. and WILSON, R. (1986) XI 8004

Health education intervention - Annotated bibliography. Paris: Unesco. (Nutrition Education Series, 13). Ed-86/WS/83.

This document focuses on actual projects in health education around the world.

EVENSEN, S. (1981) BZ 8005

An inventory of nutrition education activities in Belize. New Orleans: Department of Nutrition, School of Public Health and Tropical Medicine, Tulane University.

Presents findings of health and nutrition surveys, identifies institutions that deal with nutrition education, indicating a contact person at each and describes nutrition education activities and the purpose of institutions listed.

GUERI, D.M., JUTSUM, P., and WHITE, A.(1978) TT 8006

Evaluation of a breast-feeding campaign in Trinidad. Bulletin of the Pan American Health Organization, 12(2), 112-115.

In 1974, the Housewives' Association of Trinidad and Tobago initiated a mass media breastfeeding campaign. Five posters appeared in daily newspapers and six radio spots were broadcasted four times daily, over a five week period. During the six weeks after the campaign, mothers giving birth to babies at the two largest public hospitals, were interviewed. Knowledge scores were highly positively correlated with frequency of attendance at prenatal clinics. Ninety three per cent of the mothers recognised at least one of the posters but most had read only the large-print slogan.

GUSTAFSON, M.B. (1982) HT 8007

Recognition of health education pictures by Haitian Village women. Unpublished Ph.D. dissertation, Walden University, U.S.A. Abstract unlocated.

GUSTAFSON, M.B. (1985) HT 8008

The need for pretesting nutrition pictures based on research among Haitian villagers. Cajanus, 18(3), 169-175.

Describes a study conducted in Haiti in 1981-82, which was designed to discover whether pictorial messages were recognised and were self-explanatory to non-literate Haitian village women. A flip chart of health education pictures was shown to women drawn from four geographic sites. The findings from two (out of nine) pictures are reported here. Findings suggest that pretesting may need to be done to determine the picture recognition abilities of target groups

who have had little or no schooling and/or exposure to pictorial media.

HAMILTON, M.A. (1982) XI 8009

Nutrition education in colleges of education in the English-speaking Caribbean. Proceedings of Ninth Annual Meeting of the Caribbean Association of Nutritionists and Dietitians, pp. 24-32. Edited by J.L. Bogues et al. s.l.: CANDI.

Discusses the findings of a survey of colleges of education in ten Caribbean territories. Among aspects investigated were: local resources used in drawing up nutrition curricula; degree of emphasis placed on nutrition education; teaching methods employed; and teaching aids used. The results indicate an ambiguous situation with some institutions making a noteworthy contribution and others paying scant attention to the subject.

HAMILTON, M.A. (1983) JM 8010/1002

A suggested outline for the introduction of nutrition education at primary level in Jamaica. Primary school curriculum planning and selected case studies, pp. 56-68. Paris: UNESCO (Nutrition Education Series 4). ED-83/WS/41.

HAMILTON, M.A. (1985) JM 8011/1003

A survey of college-level nutrition education programmes in Jamaica. New developments in nutrition education, pp. 118-127. Paris: UNESCO, (Nutrition Education Series, 2).

HAMILTON, M.A., GORDON, W. and MURRAY, R.W. (1978) JM 8012/1004

Project Report (on Jamaica). Three project reports on the testing of UNESCO nutrition education curriculum planning and evaluation guides, pp. 33-94. Paris: UNESCO, ED-78/WS/62.

ISRAEL, R.C. and NESTOR, J.D. (1984) XI 8013

Nutrition education: state-of-the-art; a review and analysis of the literature. Paris: UNESCO. (Nutrition Education Series,7).

This bibliography presents trends and progress in the field of nutrition education and is divided into six sections: 1) policy issues 2) conceptual approaches 3) baseline information and entographies 4) case studies 5) exemplary materials and 6) evaluation. The section on case studies is subdivided into sections focussing on general studies and studies related to Africa, Asia, the Near East, the Pacific, Europe, Latin America, the Caribbean and North America.

JELLIFE, D.B. (1974) XI 8014

Observations on the teaching of nutrition at maternal and child health centres in some tropical communities. Environmental Child Health, 20, 232-238.

KING, W.K. (1982) XI 8015

Family life and health in Eastern Caribbean Science. Designing family life education publications for schools in the Caribbean. Edited by M.H. Alleyne. Caracas: UNESCO Regional Centre for Higher Education in Latin American and the Caribbean.

> The paper underscores the importance of health and family life education, but argues for its integration into existing programmes. Caribbean science curricula are examined in an effort to identify areas of commonalities where such integration is feasible. The objectives and methodology of such a programme are outlined.

KNIGHT, J. (1983) JM 8016/1005

Teaching child health and development concepts to primary school children. Cajanus, 16(4), 205-213.

LITCHFIELD GARCIA, F. (1981) PR 8017

Impact of three approaches to nutrition instruction on fourth-fifth, and sixth grade Puerto Rican students. Unpublished D.Ed. dissertation, Pennsylvania State University, U.S.A.

> Following a pilot study with ninety students, five hundred and forty students were divided into three groups for twelve weeks of instruction. Group A was taught by a teacher using recommended audio-visual materials and food samples; Group B received teacher instruction and audio-visual materials; and Group C was provided with self-instructional activities. All the students were pre-tested and post-tested for nutrition knowledge. Findings indicate significant differences among nutrition knowledge and food preference scores and no significant differences in attitude were obtained. The translated nutrition education unit used, was effective when supported by local community effort instead of federal funding.

LOW, D.I.D. (1970) XI 8018

Evaluating nutrition education programs on two Caribbean islands. Unpublished Ph.D. dissertation, University of California, Berkeley, U.S.A. Abstract unlocated.

OKWESA, B.A. (1982) JM 8019

Mass media and community-centered approaches in Jamaica nutrition education programme. Cajanus, 15(1), 19-27.

OKWESA, B.A. (1984) XI 8020

Perspectives on communication problems in the English-speaking Caribbean. Cajanus 17(4), 215-222.

The "misinformation" syndrome creates an often insurmountable barrier to effective communication between the health, food and nutrition sector and the wider community. Some examples from the Caribbean show that in programmes aimed at effecting change in food and nutrition attitudes or behaviour, it is very important to open up channels for more effective communication between the practitioners and the community.

PETERS, J. (1980) XI 8021

Teaching nutrition in schools: do our students practice what we teach? Cajanus, 13(2), 77-84.

Three problems faced by nutrition educators are: the irrelevance of what is taught in school to the lives some students eventually lead; reaching the community beyond the classroom; and the competitive, often inaccurate education provided by the mass media. One suggestion for overcoming these problems is to put more emphasis on the Who and How and less on the What. Strategies for using the media effectively are also discussed.

REID, U.V. (1984) XI 8022

Instructional systems development: a new approach to education planning in the health systems of the Commonwealth Caribbean: a manual for nursing and allied health instructors. Unpublished Ed.D. dissertation, Columbia University Teachers College, U.S.A.

This manual is intended for instructors in nursing and the allied health professions in the Commonwealth Caribbean. The manual was developed using a model of instructional systems development derived from several existing models and using the Information Mapping technique supported by graphics. Ten instructors confirmed its content accuracy, documentation, country-specific applicability, use of previous knowledge and development of problem-solving skills. They concluded that it is comprehensive, factual and relevant to the educational needs of the region.

REID, U.V. (n.d.) XI 8023

Report of the survey of learning needs of nurse tutors, schools of nursing, Commonwealth Caribbean. Kingston, Jamaica: PAHO/WHO.

The survey sought to identify perceived learning needs of nurse tutors as a first step to training/re-training. A mailed questionnaire was used to obtain an education profile

of respondents and information on areas of weakness for specific areas of knowledge. One hundred and nine tutors responded (52% of the sample population). The survey identified ten areas for continuing education ranked in order of priority. It is recommended that PAHO/WHO support continuing education offerings based on the areas priorized by the nurse tutors.

SMITH, B.E. (1977) JM 8024

A survey of nutrition education in secondary schools in Jamaica. Unpublished M.Sc. dissertation, University of the West Indies, Jamaica. Abstract unlocated.

STANDARD, K. AND MINOTT, O. (1983) JM 8025

Music and drama as vehicles for health education. Cajanus, 16(4), pp. 220-225.

Teaching in the hospital setting is heavily slanted towards clinical, curative or therapeutic medicine. The compulsory, five-week Community Medicine programme offered by the Department of Social and Preventive Medicine, University of the West Indies, provides an opportunity for first year medical students to live and work in rural communities and emphasises communication. An innovative way of communicating health messages is through music, dance and drama.

TOUREAU, S., PIZZARELLO, L. and LEONE, S.E. (1979) HT 8026

Evaluation of a program to prevent Xerophthalmia in Haiti. New York: Helen Keller International.

The campaign focused on adequate nutrition because Vitamin A deficiency is a major cause of child blindness. Activities included promotion of supplementation with Vitamin A capsules, radio messages and direct education at capsule distribution centres. Since the initial assessment of need in 1974-75, ocular symptoms of Vitamin A deficiency have decreased "tenfold".

WEBB, R.E. et al. (1982) HT 8027

Combining nutrition education with agricultural training in Haiti. Journal of Nutrition Education, 14(4), 133-134. Abstract unlocated.

WEBB, R.E. et al. (1985) HT 8028

Indirect influences of training fathers on the food beliefs and practices of the mothers. Cajanus, 18(2), 100-111.

A two-year study was conducted in two rural Haitian communities to determine the extent to which training

provided for the father might influence the food beliefs and practices of the mother. Nutrition and agricultural training were provided by a nutritionist and agricultural specialist and the findings suggest that the father was receptive to the information and the information diffused to the mother had influenced food avoidance and feeding practices. A follow-up survey confirmed these results.

9.

SCIENCE EDUCATION/TEACHING

Several projects on the teaching of science are in operation in The Caribbean. A global assessment of all the projects would be of interest from the point of view of current operation and possible co-ordination of efforts and of planning for future action in the area.

Publications in this area included:

1. Teaching strategies;
2. Factors affecting science education;
3. Problems in science teaching;
4. Role of science educators;
5. Overview of science education/teaching;
6. Motivation;
7. Role of the teacher in science education;
8. Rationale for Integrated Science;
9. Aims and practice of science education;
10. Directions in science education.

ALFRED, J.M. (1979) TT 9001

Argument patterns and the teaching of science. Journal of Education in Science for Trinidad and Tobago, 7 (October), 3-5.

Suggests that the way in which science teachers set out their arguments may affect students' ability to reach conclusions.

ALVARADO, N. (1983) PR 9002

Successes and failures of individualised instruction in mathematics - the Puerto Rican style. Proceedings of the Fourth International Congress on Mathematical Education, pp. 661-664. Edited by M. Zweng et al. Boston: Birkhauser.

Individualised mathematics instruction provides for the individual needs of the learner and also for continuous progress in the learning of mathematical content attitudes and skills of a particular learning level. Factors

affecting, and requirements for individualised instruction are outlined. The mathematics programme in Puerto Rico has produced curricular materials for the elementary, intermediate and high school levels, based on a systematic approach to individualisation. The disadvantages of the individualised approach relate to its implementation rather than to the teaching-learning process itself; to the need for adequate curricular materials, continuous in-service training of teachers, and the need to modify the traditional system of grades in the evaluation of achievement.

ALVAREZ DIAZ, A. (1981) CU 9003

Pedagogical effectiveness of different means of teaching in the carrying out of the chemical experiment in the school Ciencias Pedagogicas, 3 (July - December), 68-80.

This paper presents some of the most important issues of the thesis which the author presented for the defense of the Scientific Grade of doctoral candidate in Pedagogical Science before the Scientific Council of the State Pedagogical Institute VI Lenin of Moscow in April 1980. It discusses the need to combine the school chemical experiment with different means of teaching. The methods used are described and the results presented. The author recommends the adequate combination of a chemical experiment and teaching methods and suggests specific combinations to carry out experiment with equipment.

BERTY, R.B. (1975) CR 9004

A study of the relationships between classroom activities, student-teacher relationships and the characteristics of in-service secondary school science teachers of Costa Rica. Unpublished Ph.D. dissertation, Ohio State University, U.S.A.

Investigates relationships between classroom activities used and science teachers' views of activities that should be used during science teaching; student-teacher relationships that prevail and should prevail; objectives of science education as rated by science teachers; and the knowledge of the nature of science held by teachers. Concludes that while Costa Rican in-service secondary school science teachers endorse a methodology parallel to one exposed in the United States, they cannot implement it in their classrooms. The prevailing methodology produces positive student-teacher relationships and positive attitudes towards science on the part of students.

BINGHAM, E.W. and BINGHAM, K.C. (1972) JM 9005/501

An experiment in the teaching of general science. Science Notes and News (July), 28-29.

BRATHWAITE, W.E. (1985) XI 9006

Social relevance in science education: Problems and strategies in a Third World island economy. World trends in science and technology education, pp. 82-87. Edited by G.B. Harrison. London: Trent Polytechnic

BROOMES, D.R. (1981) XI 9007

Goals of mathematics for rural development. Studies in mathematics education, vol. 2, pp. 41-59. Edited by R.Morris. Paris: Unesco.

> Briefly discusses the nature of rural development and the role of education within rural development and asserts that the major problem for developing countries is to ruralize the curriculum; that is, to inculcate appropriate social attitudes for living and working together in rural communities. Five goals of mathematics for rural development are discussed. They are: the preparation of citizens as users of mathematics; the contribution of mathematicians to cultural synthesis; mathematics as an educative force in every person's life; training of mathematics and other mathematical scientists; and mathematics as a science with its own unique characteristics and beauty.

BROOMES, D.R. (1982) XI 9008

Mathematics in Eastern Caribbean Territories. London: Commonwealth Secretariat.

BROOMES, D.R. (1982) XI 9009

Teaching mathematics as a tool for community transformation. CASTME Caribbean Regional Seminar. By the Commonwealth Association of Science, Technology and Mathematics Educators. London: Commonwealth Secretariat.

> Argues that for community development and growth, the goals of mathematics education should have five clear dimensions and that individuals encounter mathematics in the context of their private, working and civic lives. The implications of these contexts for teaching and learning are discussed.

BROOMES, D.R. and ROBINSON, M. (1980) XI 9010

Some psychological principles used in teaching and learning mathematics. Unpublished paper. Cave Hill, Barbados: School of Education, University of the West Indies.

DAVIDSON SAN JUAN, I. (1982) CU 9011

How to interest students in the learning of mathematics. Educacion 12, (April-June) 75-87.

The author reports on discussions he held with several mathematics professors on methods of increasing students interest in studying mathematics. Proper development of teacher-training, an atmosphere favourable for obtaining interest, the creation of out-of-school incentives, and the involvement of the community in mathematics education are discussed. The author concludes that students must be brought to understand the great importance of complete knowledge of this discipline since the "mathematisation" of sciences is characteristic of the present scientific moment.

FIALLO RODRIGUEZ, J. (1982) CU 9012

Basic methods of teaching physics. Educacion, 45 (April-June), 52-60.

Physics as a subject is integrated in the system of the other disciplines to achieve the multifaceted and harmonious development of the personality and the communist conscience. The concept of method is analysed and specific reference is made to the basic teaching methods of physics, which are used most frequently at the average basic level and average higher level. It describes the oral, visual and practical methods. The first two basically develop physical thought and the third allows for the development and formation of specific habits. The illustrative expository method is considered the basic one for the teaching of physics at basic secondary and pre-university level since it combines actively what the teacher does to achieve the objectives set out. It is concluded that the best method depends on the teacher, and the strategies he/she uses to relate the content with life itself.

FLORES R. (1976) PR 9013

A description of the classroom verbal and non-verbal behavior of a selected group of junior high school science teachers in Puerto Rico. Unpublished Ed.D. dissertation, Temple University, U.S.A.

This study describes the verbal and non-verbal behaviour of a sample of junior high school science teachers in Puerto Rico, in order to determine the extent to which their behaviour in the classroom matches those behaviours implied by the philosophy of the Intermediate Science Curriculum Study programme (ISCS). Twenty junior high school science teachers in 13 school districts were studied. For each teacher, 5 class pupils were observed and the frequency of specific student and teacher behaviours, described in the Science Teacher Behaviour Inventory (STBI) were codified. Results indicate that the teachers behaved in a similar

manner regardless of sex, age, experience, training and area of work. Thus the classroom behaviours observed were neither consistent with the instructional nor the logistical behaviours implied by the philosophy of the Intermediate Science Curriculum Study programme. Several implications were drawn from these results for the Department of Education and institutions of higher education in Puerto Rico.

FRASER-ABDER, P. (1979) TT 9014

The teaching of elementary science. Journal of Education in Science for Trinidad and Tobago, 7, (October), 8-11.

Attempts to prepare teachers for their involvement in the introduction of science in the elementary schools by clarifying ten basic issues of elementary science education.

FRASER-ABDER, P. (1979) TT 9015

The teaching of elementary science and the development of an elementary science syllabus for Trinidad and Tobago. Unpublished paper. St. Augustine, Trinidad: School of Education, University of the West Indies.

Before commencing a science programme, teachers must have a clear understanding of fifteen issues raised in this paper. Among these are:what is science?; what is science education?; how can children begin to think like scientists?; when should children be introduced to the various science processes? and what type of science background must the teacher have? The paper attempts to clarify these issues and presents a proposed 7 year syllabus for elementary pupils from ages 5-12.

FRASER-ABDER, P. (1987) TT 9016

The rationale for active learning - The teachers' role. Paper presented at the ASTJ/ICASE Seminar on The Role and Function of Science and Technology Education in Future Human Needs, Mona, Jamaica, March 16-18.

Deals with the teacher's role in a classroom in which children are given hands-on learning experiences.

HAGGIS, S. (1983) JM 9017/702

Science and technology education in Jamaican schools. Unpublished draft report. Paris: Unesco.

HENDRY, J.A. (1974) XI 9018/601

UNESCO/UWI/UNICEF/Project/RLA/142 and the new technologies in Education. Caribbean Journal of Education, 1(1), 52-57.

HEWETT, V. (1980) JM 9019/602

The teaching of the mole concept in Jamaican high schools. Caribbean Journal of Education, 7, (April), 131-41.

ISSACS, I. (1979) JM 9020

Some suggestions for teaching mathematical problem-solving in the sixth form. Caribbean Journal of Education 6, (September) 242-58.

ISSACS, I. (1980) JM 9021/603

Teaching problem solving in sixth form college. Unpublished paper. Mona, Jamaica: University of the West Indies.

KING, W.K. (1978) VC 9022

Science education in St. Vincent. Vincentian Teacher, 1(1).

Examines the socio-historical background of science education in an effort to explain the present position. Pinpoints trends towards: a child-centred, activity-oriented approach; the integrated approach; an environmental approach; the social implications of science; and an emphasis on scientific literacy. Each trend is examined in light of constraints on implementation and possible solutions.

KING, W.K. (1978) XI 9023

The role of science education in a developing country. The Journal of the Ghana Association of Science Teachers, 17, (January).

Outlines the various roles that science could play in a developing country.

KING, W.K. (1978) XI 9024

Why teach integrated science? West Indian Science and Technology, 3, (December), 15-17.

Considers a rationale for integrated science under the following headings: the search for unity, the needs of society, the needs of students; practical reasons and the need for a general education. Reviews some arguments against integrated science, namely, the lack of trained teachers, excessive amount of material to be covered, claims of insufficient integration, burden of continuous assessment on teachers, uncertainty of the examinations. Concludes that many of the problems involved in teaching integrated science are attitudinal.

KING, W.K. (1979) XI 9025

Science and society: implications for science education. Caribbean Journal of Science Education, 1, (April), 4-7.

Looks at the pros and cons of some recent advances in science and provides a framework for a discussion of the aims of science education. Advocates that science instruction should focus on the uncertainty of scientific knowledge, its positive and detrimental effects, problems associated with ruthless use of the world's resources, and the need for and ability to make reasoned decisions which take account of all relevant constraints. Suggested topics for inclusion in the curriculum include, land, air and water resources, social medicine; pollution and conservation and science and government.

KING, W.K. (1982) BB 9026

Aims and practice in science education: Some case studies in Barbados. Unpublished Ph.D. dissertation, University of Southampton, England.

Examines the factors which influence classroom practice and traces the network of inter-connections that exist between them. Case studies show that socio-historical, contextual and internal factors are all instrumental in shaping the nature and structure of classroom transactions. The importance of factors such as the nature of the subject matter, curriculum aims, school climate, facilities and equipment, communication of information (diffusion), teacher reorientation, teacher's perception of aims and content, teaching styles, and age and ability of pupils, are explored and their relative influence discussed. Findings are compared with other research results and implications for the Barbados situation are noted.

KING, W.K. (1982) XI 9027

Caribbean science education - a decade in review. Hong Kong Science Teachers Journal, 10(2).

Reviews developments in science education in the Caribbean during the 1970s, and considers the forces which brought about changes. Examines the assumptions of the present aims and objectives of science education and suggests likely trends.

KING, W.K. (1982) XI 9028

Science education in the Caribbean. Background paper for Meeting of Commonwealth Experts on Science, Mathematics and Technical-Vocational Curricula, Cyprus, 21-28 March.

KING, W.K. (1983) XI 9029

Development of appropriate skills and qualifications in mathematics and science required to serve the community in small island states: a Caribbean case study. CASTME Journal, 3,(2).

Case study of the development of appropriate skills and qualifications to serve a small island community in mathematics and science. Includes an in-depth study of strategies of training, their effectiveness, and the main obstacles to success - finance, lack of adequate planning, and the lure of thriving metropolises.

LAMBERT, E.N. (1974) TT 9030

New directions in science education in the 70s. Journal of Education in Science for Trinidad and Tobago, 2, (October), 26-38.

States the case for a movement towards integrated science, the highlighting of science for social awareness and social responsibility and the development of a relevant curriculum. Notes that these approaches would produce different curricula from those presently used in Trinidad and Tobago and that teachers' re-education will be necessary.

MARK, P. (1978) XI 9031

Science education and development in the Caribbean: desired directions. West Indian Science and Technology, 3, (December), 11-13.

Defines some goals of science education for the Caribbean and their implications for teaching. Reviews regional efforts at science curriculum development since the 60's and stresses the need for curriculum development for the primary levels and for the development of textbooks and resource materials that reflect new approaches to science. Views the aims of higher education in science to be fostering and maintaining attitudes of scientific inquiry, the production of specialists and the eradication of scientific illiteracy.

MASTERS, J. (1979) XI 9032

Independent learning in science. Caribbean Journal of Science Education, 1, (April), 9-12.

Recently, some teachers have adopted a method of teaching science called independent learning. This development has been as a response to two main trends in education, mixed ability teaching and a call for more active participation of the student in the learning process. Independent learning based on self-contained "study guides" is also an attempt to remedy some of the problems caused by the adoption of disjointed, single worksheets. In the Caribbean context, independent learning can help offset problems associated

with the lack of qualified science teachers and the loss of teaching time due to public holidays and various functions. The preparation of study guides for selected topics is suggested, to be used alongside the normal teaching programme for other topics.

McDOOM, J.A. (1984) XI 9033

Suggestions on the teaching of practical physics at the undergraduate level. Proceedings of the Second Caribbean Conference in Physics, pp. 165-177. Edited by L.L. Moseley. Cave Hill, Barbados: Department of Physics, University of the West Indies.

Identifies reasons for the deterioration in the standard of teaching of Practical Physics at The University of the West Indies and makes suggestions for improvement. A laboratory instruction sheet for an experiment entitled "The Thermocouple and Thermal Conduction Along an Unlagged Bar, is appended as an illustration.

MELGAREJO RODRIGUEZ, J. (1981) CU 9034

How to motivate students to learn physics. Educacion, 11,(julio - septiembre), 71-78.

The author recommends that teachers create problematic situations with apparent contradictions, requiring mental operations. Students should participate actively in the search for data.

MITCHELMORE, M.C. (1977) JM 9035/604

Experiments in individualized instructions at a Jamaican teachers' college. Caribbean Journal of Education, 4 (1 and 2), 1-20.

MITCHELMORE, M.C. (1978) JM 9036

Spatial ability and geometry teaching in Jamaica. Studies in mathematics education: the mathematical education of primary-school teachers, Vol. 3, pp. 135-143 Edited by R. Morris. Paris: Unesco.

NELSON, L.H. (1978) JM 9037/605

Teaching chemistry with special reference to organic chemistry at secondary school and university in Jamaica. Unpublished M.A. dissertation, University of the West Indies, Jamaica.

NEWTON, E. and BRAITHWAITE, H. (1975) TT 9038

New directions in education in Trinidad and Tobago: Challenge and response. Comparative Education, 11(3), 237-46.

> The forces at work in the relatively brief history of Trinidad and Tobago are sketched in order to provide a background for the current situation. The paper then describes and analyses the new directions taken or proposed in education in the light of new political, social and economic circumstances.

REAY, J.F. (1981) XI 9039

CXC Integrated Science: An appraisal. Education Forum, 1, (March), 13-18.

REAY, J.F. (1982) XI 9040

Science education in the Commonwealth Caribbean. Paper presented at the IEA General Assembly, Canberra, Australia, January - February. Abstract unlocated.

REAY, J.F., ed. (1980-) XI 9041

Annotated bibliography for science education. St. Augustine, Trinidad: Faculty of Education, University of the West Indies. Three issues per year.

> An annotated bibliography of items of particular interest to science education. Items are arranged in sections which include nature and evolution of science, teaching strategies, and curriculum and examinations.

REAY, J.F. and TURNER, A.D. (1972) JM 9042

The Pilot Project to Assist the Teaching of Science in Jamaica: Annual Report January 1971 - December 1971. Unpublished paper. Mona, Jamaica: The Science Centre, University of the West Indies.

ROBINSON, B.O. (1969) DM 9043

Some problems of science teaching in the primary and all-age schools of Dominica. Report of Conference on Teacher Education in the Eastern Caribbean, pp. 100-103. Mona, Jamaica: Institute of Education, The University of the West Indies.

> The problem of teaching science in schools in Dominica stems from the lack of a suitable syllabus, teacher incompetence, lack of suitable textbooks and reference material and inadequate facilities. Assistance from the Institute of Education is required in the first three areas.

ROSE, G. (1979) XI 9044

Mathematics in science - some problems. Caribbean Journal of Science education 1, (April), 7-9.

Secondary science teachers often complain that their pupils lack basic mathematics skills which would permit smooth progress in the study of science topics. An effort can be made to promote maths/science integration, on the basis of common goals of maths/science instruction. One step in the right direction is for teachers to compile a list of mathematics requirements for various areas of study in science. Decisions have to be made about the time at which a particular topic is introduced and how it might best be handled to avoid conflict. The use of science-based laboratory investigations and of experimental data in the mathematics class could go a long way towards overcoming the problems of science/maths pupils.

SEAFORTH, C. (1981) XI 9045

A university scientist's view of secondary school science teaching in the West Indies. Journal of Education in Science for Trinidad and Tobago, 8(May), 3-5.

States that university teaching should aim to extend school teaching in developing students' ability to think. This can be done more effectively if secondary schools can develop in fifth and sixth formers, the ability to:comprehend charts, tables etc.; communicate effectively in tutorials; synthesise ideas into explanations of observed events; manipulate with confidence various elementary mathematical formulae; and relate to scientific and technological developments.

UCEBOR, A. (1986) XI 9046

Science education in schools - the Caribbean experience. In Science education and cultural environments in the Americas: A report of an Inter-American Seminar on Science Education, pp 121-127. Edited by J.J. Gallagher and G. Dawson. Washington, D.C.: National Science Teachers Association.

Gives an overview of science education in the Caribbean and notes that two basic factors contribute to low performance in the area of science education: inadequate and unstable staffing and inadequate physical laboratory infrastructure. Suggests that schools must rely more on graduates of the colleges of education to teach science. Examines the organisation of science and technical programmes in Suriname. Points out the limitations of the textbook approach to science teaching and concludes that new perspectives are needed involving redirection of goals, imaginative approaches to teaching content and method and solutions to the problem of teacher shortage.

UNESCO (1983) JM 9047/705

Development of secondary education - Jamaica. Paris: UNESCO.

WEBB, D. (1979) XI 9048

Use of technical devices in the classroom. Caribbean Journal of Science Education, 1, (April), 13-18.

Addresses the problem of student performance in science and asserts that teachers should abandon the notion that students 'ought to be able to do certain things.' Instead, teachers should identify the skills that students possess and adjust their teaching to upgrade the levels to those desired. Suggests that teachers adopt the practice of giving students something real to do, letting them learn from their mistakes; and adopt a chronology of events which seem to be widespread in real learning activities. The use of tapes, records, film loops and microcomputers in science teaching are described.

WILLIAMS, C.D.O. (1984) XI 9049

Classroom strategies for dealing with some difficulties in the Caribbean Examinations Council's syllabus in Chemistry. Unpublished M.Sc. dissertation, University of Reading, England. Abstract unlocated.

WILSON, B. (1981) XI 9050

Cultural contexts of science and mathematics - A bibliographic guide. Leeds, England: Centre for Studies in Science Education, University of Leeds.

A fully annotated bibliography with summaries of issues dealt with in the various sections. The book deals with the cultural context of school education and the influence of that context on the teaching and learning of science and mathematics. Some studies done in the West Indies are included.

WRIGHT, R.W.H. (1968) XI 9051

A programme for education in science in the West Indies. UNESCO/UWI Seminar on Curriculum and Teacher Training: Report, Appendix 8, 21p. Barbados: Printed by Cole's Printery.

Discusses the problems of science teaching in the West Indies and outlines proposals for the establishment of national science teaching improvement centres. Stresses the need for machanisms to make efficient use of existing teachers, tested prototype apparatus, frequent in-service courses and the establishment of an educational testing, examination and marking service in science. A report on the

activities of the Science and Mathematics Centre at Mona, Jamaica is appended.

10.

SCIENCE TEACHER EDUCATION

Publications in this area include:-

1. Teacher training strategies;

2. Role of the supervisors, co-ordinators and teachers;

3. Curriculum development, implementation and evaluation;

4. Implication of primary and secondary science for teachers' colleges curriculum;

5. Desirable teacher behaviour;

6. Teacher perception of school curriculum.

ADEY, P.S. (1973) XI 10001

WISCIP: a science teacher's guide and a training instrument. Report on Conference on Teacher Education in the Eastern Caribbean, 143-155. Edited by R.M. Nicholson. Cave Hill, Barbados : School of Education, University of the West Indies.

Discusses the teacher training components of the Caribbean Regional Science Project (CRSP). These are the West Indian Science Curriculum Innovation Project (WISCIP) Teacher's Curriculum Guide, which gives detailed, day-to-day guidance on teaching methods; vacation courses for Junior Secondary school science teachers; briefing sessions with teachers; consultant visits to schools three times per year; and feedback systems.

ALVARADO, N. (1973) PR 10002

The role of the mathematics supervisor in the secondary schools of Puerto Rico. Unpublished Ed.D. dissertation, Columbia University, U.S.A.

Investigates the role of the mathematics supervisor in the secondary schools of Puerto Rico as perceived by supervisors, secondary school principals, and mathematics teachers at secondary level. Among the main findings of the study are: six supervisors (46%) lack the required qualifications for the job; there is no written job description for the mathematics specialist; supervisory activities ranked by supervisors as frequently used were directly related to improving mathematics instruction; and no time is spent by supervisors on unimportant functions. Recommendations are addressed to the Department of Education, Puerto Rican universities, and supervisors.

BELLO MEDINA, A. and GONZALEZ TOLOSA S. (1982) CU 10003

The teacher-training process of mathematics in general middle school teaching. Revista Cubana de Educacion Superior, 2, No. 31982. pg. 21

The methods and the application of work procedures in the teacher training process in mathematics in General Middle School teaching is discussed. The inductive, deductive methods and analogy are compared for efficiency in the general cognitive development of the pupils. The work is based on the pedagogical research carried out by teachers of the Pedagogical Higher Institute "Juan Marinello"; on the analysis and evaluation of the results of the diagnostic test, based on the basic skills students should have before beginning the higher level and applied to first year students in different specialisations in the Bachelor of Education programme. The results show how teacher training is influenced by the preparation of the teacher.

BRATHWAITE, W.E. (1977) XI 10004

Models for teacher reorientation in integrated science. Report of the first Biennial Eastern Caribbean Standing Conference on Teacher Education, pp. 108-110. Edited by R.M. Nicholson. Cave Hill, Barbados :School of Education, University of the West Indies.

Traces the background to the Caribbean Integrated Science (CISC), discusses the modes of programme development and the aims of the programme. CISC aims at increasing emphasis on the processes of science and their social implications, reducing emphasis on remembering masses of information. The structure and mode of implementation of the teacher orientation programme, is also highlighted.

BRATHWAITE, W. E. (1978) XI 10005

In-service strategies for improving teacher abilities in science education. Report of proceedings of the Regional Primary Science Conference, pp. 156-160. [Cave Hill, Barbados]: Caribbean Regional Science Project.

BROOMES, D.R. (1968) XI 10006

Curriculum developments in mathematics for teacher's colleges in the Caribbean. UNESCO/UWI Seminar on Curriculum and Teacher Training: Report, Appendix 9(B), 10p. Barbados: Printed by Cole's Printery.

Proposal for a project which seeks to: examine the mathematics programme in teachers' colleges in order to select relevant teacher training materials, determine the mathematical competencies crucial for primary and junior

secondary teachers; and produce materials and expertise to sustain and develop the findings as to the aforementioned.

BROOMES, D.R. (1968) XI 10007

Mathematics and teacher education. UNESCO/UWI Seminar on Curriculum and Teacher Training: Report, Appendix 9(A). Barbados: Printed by Cole's Printery.

Asserts that teacher education must be concerned with the philosophy, subject matter and methodology of mathematics; it must be founded on a valid conception of the nature of mathematics; and it must deal with how children grow and learn, how to select and present materials and how to evaluate what has been done. The need for research is also emphasised.

BROOMES, D.R. (1972) XI 10008

Teacher training in mathematics for developing countries. Paper presented at the Second International Congress on Mathematical Education, Exeter, England, 29 August-2 September.

BROOMES, D.R. (1974) XI 10009

Teacher training with special reference to teaching primary school mathematics in developing countries. Caribbean Journal of Education 1 (June), 42-51.

The findings and data obtained from mathematics projects in the Caribbean, particularly the St. Lucia Mathematics Project, indicate possible approaches to teacher training in mathematics. Three main strategies are described for curriculum development, mathematics curriculum and mathematics. These strategies, allow teachers to learn mathematics while teaching it; ensure that teaching methods used and devised by teachers are based on the nature of mathematics; and, generate teaching methods based on the actual experiences of the children and their intellectual development.

CHARLES, V. (1979) XI 10010

Implications of primary science curriculum developments for teachers' colleges. Science education for progress: A Caribbean perspective. pp 72-76. Edited by C.Lancaster and W.King. London: International Council of Associations for Science Education.

Given the developments in primary science curricula, teachers' colleges in the English-speaking Caribbean will have to produce students who understand and appreciate how children learn science, what science is and what science education implies; students who can blend science content and methodology in order to make science a worthwhile

venture in schools; and students who are able to use the environment as a science laboratory.

KING, W.K. (1977) XI 10011

Towards a science curriculum for Eastern Caribbean teachers' colleges. Science education for progress: A Caribbean perspective, pp 94-101. Edited by C.Lancaster and W.King. London: International Council of Associations for Science Education.

Outlines the salient points for consideration in developing a programme for would-be primary science teachers with reference to the objectives of Caribbean primary science curricula, the needs of society, the needs of the student teacher, and curriculum content, methods and evaluation.

KING, W.K. (1983) XI 10012

Proposal for joint assessment in secondary science in the Eastern Caribbean teachers' colleges. Report of the Fourth Biennial Eastern Caribbean Standing Conference on Teacher Education, pp 51-68. Edited by D.C. Clarke. Cave Hill, Barbados: School of Education, University of the West Indies.

A two-part assessment procedure is detailed, namely a College based continuous assessment (40%) and a School of Education based examination (60%). A Draft Syllabus for Secondary Teacher Training Course (Science) is outlined.

MARK, P. (1980) TT 10013

The identification of desirable teacher behaviors for the content of a program for the preparation of secondary level science teachers in Trinidad and Tobago. Unpublished Ed.D. dissertation, Columbia University Teachers College, U.S.A.

Phase 1 of the study sought to obtain general information about secondary level science teachers in the country to enable proper sampling of this group in the second phase. Phase 2 sought the opinions of practising science educators in Trinidad and Tobago on the importance of specific teacher behaviours for secondary level science teachers and on the time in a teacher's career when these behaviours should be acquired. The seventy-five behaviours rated as important, were used as the basis for specifying the content of a programme for preparing the secondary level science teachers.

MARK, P. (1986) TT 10014

Bridging the communication gap in classroom science education: new roles for science teacher education. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference, pp 182-185. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

Proposal for a study which seeks to examine ways and means by which secondary level instruction can be designed to wipe out/reduce the accumulated deficits in basic academic skills. Specfically, the study will examine new departures in secondary science education.

MOHAN-RAM, V.(1976) GY 10015
Metrication in mathematics for teachers' colleges in Guyana. Unpublished M.Ed. dissertation, University of Western Ontario, Canada.

In this mathematics curriculum the Metric System was suggested in place of the Imperial System. The former was in keeping with the changes which were taking place in mathematics programmes in the early seventies. It suggested as a core , the five basic metric units - the metre, the litre, the gram, the second and the degree Celsius. These were expanded to include every possible aspect of the unit to aid interpretation, transfer and understanding of the unit. Suggestions were made as to how the metric system should be introduced at the college and school levels, especially when the Imperial System was the system used. The curriculum contained the major sections viz. rationale, objectives, material to be used, teaching aids, content and evaluation. It also briefly suggested how it should be taught at the primary level. A list of specific teaching aids and appropriate metric test books are appended.

MORRIS, R.W. and THOMAS, L.F. (1980) XI 10016

Caribbean cooperation for curriculum development and reform in teacher training. Paris: Unesco. (Experiments and Innovations in Education, No. 39).

The evolution of a joint UNDP/UNICEF project is discussed. The main aims of the project were to build up resource materials for use in teacher training, and to foster development of the curriculum for 1 to 15 year old pupils, in the areas of language, mathematics and science. Books and audio materials were purchased for the libraries of the teachers' colleges, the teachers' centres and the Institute of Education. Workshops in language arts, mathematics, integrated science, educational administration, foundation

technology were conducted. The outcomes of the workshops are elaborated in separate sections of the study which concludes with an assessment of some of the project's achievements.

ORTIZ PLATA, G. (1977) PR 10017

Expectations for the role of the science coordinators in Puerto Rico as perceived by themselves and their immediate role associates at the school district level. Unpublished Ed.D. dissertation, New York University, U.S.A.

Analyses the expectations for the role of the science co-ordinator in the public schools of Puerto Rico as perceived by selected school district superintendents, school principals, science teachers and by the co-ordinators themselves. The Science Co-ordinator's Role Expectation Questionnaire was prepared and distributed to 865 participants, of which 717 responded. Although the four samples agreed among themselves to some extent on the expectations for the role of science co-ordinator, the amount and degree of consensus varied. The development of a clearly defined set of expectations was suggested using as a basis all the items on which there was substantial agreement.

OWEN, M. (1977) BB 10018

Innovation in science education organisation through teacher involvement. Report of the First Biennial Eastern Caribbean Standing Conference on Teacher Education, pp. 123-132. Edited by R.M. Nicholson. Cave Hill, Barbados: School of Education, University of the West Indies.

Describes ways in which available human resources can be organised to improve the state of science education in Barbados, drawing from motivation and organisational theory. The Science Education Advisory Committee (SEAC), consisting of teachers, administrators, teacher educators, etc., was set up to involve teachers in planning all aspects of development in their subject areas and to reduce the management span of the Ministry of Education's science personnel. To date, six sub-committees have organised and run 8 teacher training workshops and made progress towards revised curricula for schools. The ultimate goal is a system in which teachers, teacher educators and administrators, see themselves as working in harmony towards the same goals.

REAY, J.F. and WEST, S. (1983) TT 10019

The training of teachers and technicians for practical work in school science in Trinidad and Tobago. New trends in school science equipment, pp 131-140. Paris: UNESCO.

Outlines the background to and status of science education at the tertiary, secondary and primary levels in Trinidad and Tobago. Among old problems for teacher training to resolve are: the lack of understanding by teachers of the discipline they teach; poor knowledge and attitudes about new equipment and approaches; and unwillingness of teachers to consult sources of ideas. Describes attempts to reorient teachers towards the solution of the problems. Recent government decisions providing an expansion in opportunities for improving teaching practices are reviewed.

SOUTH-GUY, E. M. (1981) JM 10020

Educating student teachers to apply the Guilford Structure of intellect model to induce active response learning in science classes in Jamaica. Unpublished Ed.D dissertation, Columbia University Teachers College, U.S.A.

STORR, E.R. (1982) BS 10021

Effective teacher training for the improvement of mathemetics education in the Bahamas. Unpublished Ph.D. dissertation, Loughborough University of Technology, England.

This research is concerned with the on-going development of the secondary mathematics curriculum in The Bahamas. In order to determine whether pupils assimilated mathematical ideas into a schematic structure, and could retrieve and use them as final behaviours outlined in the syllabuses, data from two diagnostic tests administered to pupils of 13+ and 15+ years respectively, were analysed. For the former age range, 377 pupils completed an Objective Test containing 50 items and for the latter age range, 241 pupils attempted a Choice-Type Test with the instruction to choose any 10 of the total of 14 questions. On each of these tests the following indices per question are presented: popularity, facility, mean ability, and discrimination. Reliability and validity, were calculated and determined by KR20 formula. The most important finding of this research is that a massive percentage of underachievement is occurring in the high schools thus reflecting instructional ineffectiveness as well as inefficiency at learning tasks. The strength and clarity of the evidence compels the inescapable conclusion that a well-thought-out programme of in-service education for teachers of mathematics education must be mounted in the Bahamas as a matter of urgent necessity.

THOMPSON, A.J. (1982) JM 10022

Programme for the improvement of the pre-service mathematics education of secondary teachers at the Teachers College in Jamaica. Unpublished Ed.D. thesis, Columbia University Teachers College, U.S.A.

TORRES-HERNANDEZ, N. (1981) PR 10023

The perceptions of junior high school science teachers concerning the prescribed curriculum in Puerto Rican public schools. Unpublished Ph.D. dissertation, University of Connecticut, U.S.A.

Twenty junior high school science teachers from fifteen school districts of the Arecibo Educational Region were interviewed. The data obtained were analysed to determine if the teachers' perceptions of teacher preparation, goals and objectives, teaching methods, adequacy of facilities, materials and supplies, and need for curriculum reform, are compatible with the official science curriculum. The findings indicate the need: to upgrade teacher training requirements; for clarifying goals and objectives; to acquire facilities, materials and supplies to facilitate use of the best teaching methods; to revise the curriculum with significant teacher input; and for greater teacher participation in setting curricular goals.

YING, E.L. (1982) JM 10024

Evaluating and teaching metric measurement of length and area in a group of teachers' college students. Unpublished M.Ed. dissertation, University of the West Indies, Jamaica. Abstract unlocated.

11.

SCIENTIFIC LITERACY

Publications in this area include:-

1. Role of out of school science popularisation programmes;
2. "Street Science";
3. Status of factors affecting scientific literacy;
4. Understanding non-technical words in science.

FRASER-ABDER, P. (1985) XI 11001

The role of out-of-school science popularization programmes as a support to primary school science teaching. Problems of Science popularization in the Caribbean: Proceedings of a seminar workshop, pp. 8-23. Edited by S.Laurent. St. Augustine, Trinidad: Caribbean Industrial Research Institute.

> Some problems encountered in primary science teaching in Trinidad and Tobago include, the lack of formal science training among primary school teachers, day to day problems of classroom management and the influence of pre-school concepts in science. A programme consisting of well-organised science fairs, mobile or fixed science and technology museums, and science learning centres, should help to alleviate some of the existing problems in Trinidad and Tobago and the rest of the Caribbean. The syllabuses followed in some of the Caribbean islands are appended.

GEORGE, J.M.(1986) TT 11002

An analysis of science - related social beliefs of lower ability secondary school students in Trinidad and Tobago. Unpublished paper. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

> In an effort to find an explanation for the poor performance of lower ability science students, the background experiences of students were examined by analysing traditional customs and beliefs which seem to have a scientific base. The term "street science" was used to refer to those beliefs. The research indicated that street science abounds in the local community and that lower ability students are highly committed to a significant portion of it. Sixty-six per cent of the street science data collected is not supported by conventional scientific principles, even though at face value the items seem to have a scientific base. Since so many of the street science

concepts are not supported by conventional scientific principles, it is likely that the earlier acquistion of street science concepts by students interferes with the learning of conventional science in schools. The research findings point to the need for paying closer attention to this form of background experience of students.

GEORGE, J.M. (1986) TT 11003

'Street science' in Trinidad and Tobago - analysis and implications for teaching conventional science. Science Education Research in Latin America and the Caribbean: Proceedings of a Conference pp. 252-265. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

'Street science' refers to those social customs and beliefs that offer explanations for phenomena falling within the domain of conventional science and whose explanations sometimes differ from those based on scientific evidence. One hundred items were collected from 'experts' and science students, classified and analysed. Sixty-six per cent of these was not supported by scientific evidence and dealt with such concepts as the effect of nightfall on digestion and the powers of the moon. The implications of science-related prior experiences of students for science teaching are discussed.

GEORGE, J.M. (1986) TT 11004

'Street science' - an analysis of science-related social beliefs of secondary school students in Trinidad and Tobago. Unpublished M.Ed. dissertation, Queen's University, Canada.

Seeks to explain why lower ability students have been performing poorly on external science examinations. Traditional customs and beliefs which seem to have a scientific base - "street science" - are examined. The study shows that street science abounds in the local community, lower ability students are highly committed to it and two-thirds of the information collected is not supported by conventional scientific principles. It is likely that the earlier acquisition of street science by students interfaces with the learning of conventional science in schools.

GEORGE, J.M. and GLASGOW, J.(1987) XI 11005

Conventional science and street science in the West Indies. Paper presented at the 2nd International Seminar on Misconceptions and Educational Strategies in Science and Mathematics, Ithaca, New York, July 26-29.

'Street science' is defined as "those social customs and beliefs that deal with the same content areas treated in

conventional science but which sometimes offer different explanations to those offered in conventional science." A body of street science from Jamaica and Trinidad and Tobago has been identified and some of the underlying principles are extracted. These include the recognition of a simple, immediate and direct cause/effect system; a readiness to generalise; and the ascription of special powers/characteristics to particular conditions / processes / objects. The findings suggest a value system different from that inherent in conventional science, a difference that should influence the way in which classroom science is presented.

GLASGOW, J.L. (1981) JM 11006/801

Scientific literacy in a selected sample of Jamaican grade nine students from new secondary and all age schools. Unpublished Ph.D. dissertation, University of the West Indies, Jamaica.

GLASGOW, J.L. (1984) JM 11007/802

Scientific literacy: Its meaning and its importance for Jamaica. Unpublished paper. Mona, Jamaica: Faculty of Education, University of the West Indies.

GLASGOW, J.L. (1985) XI 11008/401

The role of out-of-school science popularization programmes as a support to secondary school science teaching. Problems of science popularization in the Caribbean: Proceedings of a seminar workshop pp. 24-48. Edited by S.Laurent. St. Augustine, Trinidad: Caribbean Industrial Research Institute.

GLASGOW, J.L. (1986) JM 11009

Factors affecting scientific literacy in Jamaican grade nine students. Science education research in Latin America and the Caribbean: Proceedings of a Conference, pp. 234-252. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

GLASGOW, J.L. (1986) JM 11010/803

Science education and superstition. Torch 29, 1-11. (Kingston, Jamaica: Ministry of Education).

KING, W.K.(1984) XI 11011

Out-of-school science activities - retrospect and prospect in the Caribbean. Teaching science out-of-school with special reference to biology, pp 101-108. Edited by G.R. Meyer and A.N. Rao. Hamburg: International Union of Biological Sciences, Commission for Biological Education.

Formulates eleven aims of out-of-school science in the Caribbean, discusses their implications for finance,

examinations, curriculum development, and teacher training, and describes some out-of-school science activities in the Caribbean. These are classified as: activities emphasising applied sciences; science teachers' associations, science projects and exhibitions; clubs and societies; and regional associations.

REAY, J.F.(1981) XI 11012

Understanding of non-technical words in science. Journal of Science for Trinidad and Tobago 8 (May), 14-16.

Presents comparative scores of various groups of Trinidadian students, Jamaican trainee teachers and grade ten Austrialian students, in a test of understanding of some difficult non-technical words used in science. Although the Trinidadian results cannot be generalised to the country as a whole the data may be useful to teachers familiar with the schools concerned.

STEWARD, J.W. (1978) JM 11013/502

Understanding of non-technical words in science. Science Education Centre Newsletter, 10(1): 20-21

PART II

AN OVERVIEW

SCIENCE EDUCATION RESEARCH PERSONNEL

ANTIGUA

HILL, Eustace B.Sc., M.Ed.
Science Co-ordinator
Ministry of Education, Culture and Youth Affairs
Church Street
St. John's

BAHAMAS

BANCROFT, David B.Sc., M.Ed., Community Counsel,
University of London. Teacher Certificate
Head of Science Department (Jr. Secondary School)
Ministry of Education

BOOTHE, Cynthia B.Sc., Dip. Ed.
Education Officer (Science)
Ministry of Education
P.O. Box N3913/14
Nassau

TAYLOR, Beverly J.T. B.Sc., M.Sc. (Admin. & Supervision)
Teachers Certificate
Senior Education Officer (Science)
Ministry of Education
Nassau

BARBADOS

BRATHWAITE, Workely E. B.Sc. (London-UCWI), M.Ed. (London)
Lecturer, Science Education
Faculty of Education
The University of the West Indies
P.O. Box 64, Cave Hill
Bridgetown

BROOMES, Desmond R. B.A. (London), M.Ed., Ph.D., (Toronto)
Senior Research Fellow
Research and Development Section
Faculty of Education
The University of the West Indies
Cave Hill
P.O. Box 64
Bridgetown

HALLIDAY, James A. B.A., Dip.Ed., (UWI), M.Sc. (Central Connecticut), M.A. (OISE)
Assistant Registrar
Measurement and Evaluation Division
Caribbean Examinations Council
The Garrison
St. Michael

KING, Winston K. B.Sc. (Mt. Allison), M.Ed. (London), Ph.D. (Southampton), C.Biol., MIBiol.,(Inst. of Biology ,London).
Senior Lecturer
Research and Development Section
Faculty of Education
The University of the West Indies
Cave Hill
P.O. Box 64
Bridgetown

ROSE, Gerald B.Sc. (UWI), M.Sc. (Keele), Dip.Ed. (UWI)
Lecturer
In-Service Education Diploma Programme
Faculty of Education
The University of the West Indies
Cave Hill
P.O. Box 64
Bridgetown

BELIZE

ECK, David
Education Officer
Ministry of Education
P.O. Box 33
Belize City

DOMINICA

LANCE, Rupert B.Sc., M.Ed. (University of Reading)
Clifton Dupigny Community College
Roseau

GUYANA

LOWE, M.T. M.A. (Dalhousie University)
Faculty of Education
University of Guyana
Turkeyen Campus
Box 101110
Georgetown

GRENADA

HENRY, Elizabeth B.Sc., currently completing post-graduate study
C/o Ministry of Education
St. George's

JAMAICA

COMMISSIONG, F. B.Sc., Dip.Ed., M.A.(Ed.)
Senior Lecturer
Faculty of Education
The University of the West Indies
Mona
Kingston 7

GLASGOW, Joyce L. B.Sc. (London-UCWI), M.A. (Ed.), Ph.D, Dip.Ed., H.Dip.Ed. (UWI)
Lecturer
Department of Teacher Education Development
Faculty of Education
The University of the West Indies
Mona
Kingston 7

HAMILTON, Marlene B.Sc., M.A.(Ed.), Ph.D., Dip.Ed., H.Dip.Ed. (UWI)
Senior Lecturer
Department of Educational Studies
Faculty of Education
The University of the West Indies
Mona
Kingston 7

LEO-RHYNIE, Elsa B.Sc., Ph.D., Dip.Ed.(UWI)
Senior Lecturer
Department of Teacher Education Development
Faculty of Education
The University of the West Indies
Mona
Kingston 7

PERSAUD, Gagindra M.A., Ph.D., (Charles)
Research Fellow
Department of Teacher Education Development
Faculty of Education
The University of the West Indies
Mona
Kingston 7

THOMAS, Jean B.Sc., Dip.Ed., Post-graduate student
Senior Lecturer
Church Teachers' College
Mandeville
Jamaica

TRINIDAD AND TOBAGO

BRATHWAITE, Brader A. B.Sc., M.Sc., Dip.Ed. (UWI), M.Ed. (Toronto), Ed.D.
Co-ordinator of Computers in Education
Curriculum Division
Ministry of Education
Loinsworth Building
Hayes Street
Port-of-Spain

BYRON, Maria B.A., Dip.Ed. (UWI)
Lecturer
Teaching in Mathematics
Faculty of Education
The University of the West Indies
St. Augustine

CLARKE, Shirley B.Sc., Dip.Ed. (Management Studies), M.Ed. Measurement and Evaluation
Ministry of Education
Loinsworth Building
Hayes Street
Port-of-Spain

DOUGLASS-MANGROO, Sharon B.Sc. (UWI), M.Sc. (Agric.Ed.) (Michigan State)
Curriculum Officer
Curriculum Division
Ministry of Education
Loinsworth Building
Hayes Street
Port-of-Spain

DURGADEEN, Lucy B.Sc., Dip.Ed. (UWI), M.Ed, Ph.D. (Pennsylvania State)
School Supervisor II (Science)
Ministry of Education
Loinsworth Building
Hayes Street
Port-of-Spain

FRASER-ABDER, P. B.Sc. (UWI), M.Ed., Ph.D. (Pennsylvania State), Cert. in Education Planning (Pennsylvania State).
Lecturer in Science Education
Faculty of Education
The University of the West Indies
St. Augustine

GEORGE, June M. B.Sc. (UWI), M.Ed. (Toronto), M.Ed. (Queen's)
Lecturer
Teaching in Science
Faculty of Education
The University of the West Indies
St. Augustine

LUTCHMAN, Claude Teachers' Certificate, B.A. (UWI),
Dip. in Maths. Ed. (Southampton),
Dip. Ed. (UWI), Dip. in Curriculum
and Instruction (Calgary)
Temporary Lecturer
Teaching of Mathematics
Faculty of Education
The University of the West Indies
St. Augustine

MARK, Paula B.Sc., Dip.Ed. (UWI), M.A., M.Ed., Ed.D (Columbia)
Lecturer
Teaching in Science
Faculty of Education
The University of the West Indies
St. Augustine

MOHAN-RAM, Vivekanand B.Sc. (Puerto Rico), Dip.Ed. (UG),
M.Ed. (Western Ontario)
Lecturer
Teaching of Mathematics
Faculty of Education
The University of the West Indies
St. Augustine

MORRIS, Jeanette M.A. (Edinburgh), M.Sc. (Georgetown)
Dip.Ed. (UWI)
Lecturer
Teaching of Foreign Languages
Faculty of Education
The University of the West Indies
St. Augustine

PRIME, Glenda M.A. (Ed) Student
Faculty of Education
The University of the West Indies
St. Augustine

QUAN SOON, Stephen B.A. (UWI), M.Ed. (Toronto)
Lecturer
Teaching of Mathematics
Faculty of Education
The University of the West Indies
St. Augustine

RAHAMAN, Nadira M.A.(Ed.) Maths & Computer Edu. (Ohio State University)
ASJA Girls College
San Fernando

RAMHARACKSINGH, Ronald B.Sc., M.Sc. (Michigan State)
Curriculum Supervisor (Agric. Educ.)
Ministry of Education
Hayes Street
Port-of-Spain

SAMPSON-OVID, Lystra B.Sc. (Agric.Ed.), M.Ed. (University State)
Lecturer
Agriculture Education
Valsayn Teachers College
Old Southern Main Road
Spring Village
Curepe

THOMPSON, Daniel B.Sc., M.Sc. (Agric.Ed.) (Michigan State)
Lecturer
Eastern Caribbean Institute
of Agriculture and Forestry
Centeno

WEST, S. B.Sc., Dip. Ed., M.Sc. (UWI), M.A. (Ed.) Student
Faculty of Education
The University of the West Indies
St. Augustine

13.

RESEARCH IN PROGRESS OR PROPOSED*

ANTIGUA

HILL, Eustace

- Research on role vs discovery method
  Discovery method as it relates to exam based upon science content
- Research needed for process skills in CXC

BAHAMAS

Research Projects

Commonwealth Secretariat Pilot Study

In 1978 a pilot study into Developing Effective Science and Mathematics Education in Third World Countries was conducted under the auspicies of the Commonwealth Secretariat. The Bahamas was a primary target. Chapter three of the report subsequent to this study revealed the following:-

"Primary school children like Science as a school subject and also as a source of enjoyment."

Some of their reasons were:-

1) Science is easy
2) Science teachers teach about the parts of their body
3) Science is fun

The responses of Junior and Senior Secondary students were more negative and this aspect of "Attitudes to Science" by students at this level is a serious consideration of Secondary Science curriculum developers as they strive to improve the implementation of Secondary Science Programme.

*Sources of information
1. Questionnaire
2. Personal communication

Projects Completed

	Project Title/ Topic	Principal Researcher(s)	Source of Report
1.	Teaching of Science in Primary Schools	Primary Science Curriculum Committee	Survey
2.	Development of General Science in Bahamian Primary School	David Bancroft Cynthia Boothe Beverly Taylor	Slide/ Tape
3.	Evaluation of Primary School	Testing and Evaluation Unit and Science Unit of the Ministry of Education (M.O.E.)	Survey

Research in Progress

	Project Title/Topic	Principal Researcher
1.	Ecology and Conservation Needs of the Primary Teacher and Student	Science Unit (M.O.E.) Primary Science Committee and Bahamas National Trust
2.	Progressive Performance of Family Island & New Providence students in National 10+ exam and and various 15+ examinations	Science Unit and Testing and Evaluation (M.O.E)
3.	Availability of local Scientific sites for Field-trip Visits/ Resource Person	Science Unit and Curriculum Development Committees (M.O.E.)

BANCROFT, David

- Curriculum development implementation and evaluation
- Attitude towards science

BOOTHE, Cynthia

- Attitude towards science
- Curriculum development, implementation and evaluation

TAYLOR, Beverly J.T.

- Curriculum development, design, implementation and evaluation for students and teachers
- Attitude towards science

BARBADOS

Ministry of Education

Response to questionnaire indicates that no science education research has been done at this institution; is in progress or in the planning stage.

The main research skills resides in The University of the West Indies, Faculty of Education, The Ministry of Education and The Caribbean Examinations Council. In some of these institutions research is not the most conspicuous activity. The greatest contribution is being made by The University of the West Indies, Faculty of Education. Even here teaching, supervision and curriculum development activities have overshadowed research. There is a small research and publications fund available to the Faculty. Publication is normally sought in the Caribbean Journal of Education or in international journals. There are currently no programmes at the Masters or Ph.D. Level, but a Masters Programme is expected to be offered in the near future.

USAID

The Regional Development Office/Caribbean does not undertake any science education research.

BRATHWAITE, Workoly E.

- School-based assessment of practical work
- Importance of teaching skills and effectiveness of The University of the West Indies In-Service Teacher Education Programme, as perceived by teachers in training and their tutors
- Development of simple computer programmes for classroom teaching and testing
- Expectations and outcomes of practical work in the classroom
- teacher education evaluation (with E.H. Newton)
- Survey of available resources and of the potential and limitations of the use of computers in Barbadian schools (with G. Rose)

BROOMES, Desmond R.

- Maths Education

HALLIDAY, James A.

- Construct validity of CXC Mathematics Examination
- Error analysis of responses to CXC Basic Mathematics
- Success in mathematics as a predictor of success in science subjects
- Self-concept of secondary students and mathematics achievement.

KING, Winston K.

- Science curriculum development, implementation and evaluation
- Science curriculum assessment procedures
- Development of materials for teachers' colleges science curriculum in the Eastern Caribbean for training secondary school teachers
- Aims and practices in science education

ROSE, Gerald

- Error analysis in mathematics: learning from children's mistakes
- Development of computer software for the analysis of open-ended, short-answer questions
- Project PLEASE: Promoting Learning Effectiveness and Success in Examinations
- Retention, Application and Problem solving in Mathematics (RAPSIM)

B.Ed. Students

- Relationship between learning style, perceptions of the Biology Department and academic achievement in biology students in St. Kitts
- The effect of two teaching strategies and the utilisation of advance organisers on meaningful acquisition of science concepts and principles among a sample of teachers at the St. Vincent Teachers' College.

BELIZE

- Little research; mostly at secondary level and teacher training
- Four current research projects on the Relevant Education for Agriculture and Production Programme (REAP), but they are not directly related to education
- Current projects related to conditions of life, child survival and local food
- Little money for science education research

Recommendations:
(1) Need for dissemination beyond existing stuctures using district councils and the mass media. (2) Need for research network which meets periodically to exchange ideas and for documentation of research.

DOMINICA

No research in progress at the current time.

GRENADA

Ministry of Education

Response to questionnaire indicates that no science education research has been done at this institution, is in progress or in the planning stage.

GUYANA

- Economic conditions are not favourable for research
- Research consists mainly of data collection which allows for synthesis of solutions at a basic level.

JAMAICA

Ministry of Education

Response to questionnaire indicates that no science education research has been done at this institution, is in progress or in the planning stage.

The University of the West Indies, Research and Publications Unit is the main source of funding for research. It has been indicated that the facilities for computer hardware/software are excellent, those for Library/Documentation are good and other facilities available are inadequate.

COMMISSIONG, F.

- Curriculum development: language difficulty and its effect on science learning.

GLASGOW, Joyce L.

- Levels of performance on a Process of Science Test of Caribbean Grade 10 (Form IV) students (with P. Fraser-Abder)
- Attitude and attainment in school subjects among high school and teacher training college students
- "Street Science" of Jamaica and Trinidad and Tobago (with June George)

- Scientific literacy
- Science and superstition
- Process test development
- Subject preferences

HAMILTON, Marlene

- the prediction of academic success: completion of a longitudinal study, tracing the academic progress of high school students through school and tertiary-level institutions
- Metacognition research project: (with three other staff members) geared toward establishing norms and relationships between spatial, logical and verbal ability, creativity and learning styles among older Jamaican adolescents. Special area of concern - creativity.
- Science/phychology - sex bias, attitude to science

LEO-RHYNIE, Elsa

- Evaluation of the Teacher Training Colleges' Diploma Programme
- Investigating the learning styles of Jamaican Sixth Formers
- Science/psychology - sex bias, relationship to cognitive structure

PERSAUD, Gayindra

- Test of cognitive development of children aged 4-10 years
- Giftedness and talentedness among Jamaican school children
- Age and children in cognitive-functioning.

SUE-HO, Lorna

- Evaluation of CXC school based assessment

THOMAS, Jean

- Scientific literacy
- the learning of different topics in biology
- teaching styles in integrated science in grades 7-9.
- continuous assessment in mathematics
- verbal problems in mathematics

ST. LUCIA

Ministry of Education

Response to questionnaire indicates that no science education research has been done at this institution, is in progress or in the planning stage.

National Research and Development Foundation of St. Lucia
Barnands Hill
P.O. Box 1097
Castries

Research in Education has been restricted to Literacy Education and General Adult Education.

TURKS AND CAICOS ISLANDS

Ministry of Health, Education
Education Department
Grand Turk

Response to questionnaire indicates that no science education research has been done at this institution, is in progress or in the planning stage.

TRINIDAD

BRATHWAITE, Brader A.

- Teachers as persons, theorists and practitioners
- Computers in education

BYRON, Maria

- Designing a test to measure spatial ability in 12 - 15 year olds
- The relationship among spatial visualisation, number sense and problem-solving in mathematics
- An Investigation of the Effect of Language Variables on Problem-Solving in Mathematics at the Standard Three Level (completed).
  In this study, tests of mechanical computation and word problem-solving measured mathematics performance. A Gates-MacGinitie Test of Reading Comprehension Level C Form 1, was used to measure reading comprehension ability. The sample of 542 students was found to be more competent with the mechanical than the word problems. Overall, the findings support the thesis that language is an important factor in problem-solving in mathematics.

DOUGLASS-MANGROO, Sharon

- Agricultural Science Curriculum development and implementation in secondary schools
- Readiness of agricultural science students in secondary schools

DURGADEEN, Lucy

- Metacognition and information processing
- Integrating science and technology
- Science popularisation
- The effects of orienting instructions and elaborations on understanding and memorability Inter-American Journal of Psychology, forthcoming.

FRASER-ABDER, P.

- Attitudes to science and science teaching
- Cross-cultural studies in science education, scientific attitudes, cognitive development and concept learning
- Science curriculum development, implementation and evaluation

GEORGE, June

- A comparison of the readibility levels of Social Studies Language Arts and Science texts used by Standard 5 and Form 1 classes in Trinidad and Tobago (with V. Jules and J. Morris)
- Analysis of the nature and function of the CXC Integrated Science (Single Award) Basic Proficiency Level Syllabus.
- An Analysis of the nature and function of the CXC Integrated Science (Single Award) Basic Proficiency Level Syllabus (UNESCO funded)
- Preparation of self-teaching modules on science and technology in Trinidad and Tobago with an emphasis on native technology (UNESCO funded)

LUTCHMAN, Claude

- Problems of teaching mathematics in primary schools
- Impact of teacher training on primary school mathematics teachers

MOHAN-RAM, Vivekanand

- Comparison of the mathematics performance of 10-11 year olds in England and Canada with that of their counterparts in Trinidad and Tobago

MORRIS, Jeanette

- An investigation of gender-related differences in classroom interaction (teacher-student, student-student) in the fourth year of secondary school, in different curriculum areas including science
- the self-perception of female secondary school students and its relation to their occupational aspirations

PRIME, Glenda

- The modifiability of cognitive styles and their relationship to achievement in biology

QUAN SOON, Stephen

- Revision paper (10) in CXC General Mathematics
- Teacher Made Tests - a test for classroom teachers
- A teacher census (with Maria Bayron)

SAMPSON-OVID, Lystra

- Curriculum Development for 7-9
- Curriculum Implementation K-7
- Evaluation in Agriculture Education and Extension

WEST, S.

- An evaluation of the development and implementation of the CXC Biology Syllabus in Trinidad and Tobago

CARIBBEAN

BUTTS, D., BARUFALDI, J., DE TURK, L., and FRASER-ABDER, P.

- Implementing Science Curriculum Change in the Caribbean, Latin America and the U.S.A.

GEORGE, J. and GLASGOW, J.

- Comparative study of street science existing in Trinidad and Tobago with that existing in Jamaica.

- A study of the content areas in which conventional science and West Indian street science converge

GLASGOW, J. and FRASER-ABDER, P.

- Levels of performance on a Process Science Test of Caribbean Grade 10 (Form IV) students

HAMILTON, M. and FRASER-ABDER, P.

- Scientific attitudes among Fourth Form students in the Caribbean

JOINT COMMONWEALTH SECRETARIAT/UNESCO PROJECT

- Primary Science Teacher Training Project aimed at training educators in teaching primary science.

WHITE, A., BERLIN, D., FRASER-ABDER, P., BARNETT, D. and ESQUIVEL, J.

- The use of concrete, manipulative materials and computer simulation for learning elementary school science and mathematics in Latin America, Caribbean and United States.

JOURNALS

JOURNALS IN WHICH CARIBBEAN RESEARCHERS HAVE PUBLISHED THEIR RESEARCH.

ARITHMETIC TEACHER
1954 12/yr Rates available on request
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 20091
USA

BULLETIN OF TECHNICAL FILE CARDS ON LOW-COST EQUIPMENT FOR SCIENCE TEACHING
1983
Unesco Regional Office for Education in
Latin America and the Caribbean
20 Casilla Postal 3137, Enrique Delpiano 2058,
Santiago, Chile

CAJANUS: THE CARIBBEAN FOOD AND NUTRITION INSTITUTE QUARTERLY
1968 4/yr
Caribbean Food and Nutrition Institute
P.O. Box 140, Kingston 7
Jamaica.

CARIBBEAN CURRICULUM
1985 TT$5
Faculty of Education, UWI
St. Augustine, Trinidad

CARIBBEAN JOURNAL OF EDUCATION
1974 3/yr US$15
Faculty of Education
The University of the West Indies
Mona, Kingston 7
Jamaica

CARIBBEAN JOURNAL OF SCIENCE EDUCATION
1979 Ceased Publication
Caribbean Regional Science Project
School of Education
University of the West Indies, Cave Hill
P.O. Box 64 Bridgetown, Barbados

CASTME JOURNAL
1957 6/yr (formerly CASME journal)
Commonwealth Association of Science,
Technology and Mathematics Educators
36 Craven Street, London WC2N 5N6
England

CONNECT-UNESCO/UNEP International Environmental Education Newsletter
1976. 4/yr (Eng., Fre., Span., Rus., and Ara.)
Unesco 7 Place de Fontenoy
75700 Paris, France

EDUCATIONAL STUDIES IN MATHEMATICS
1970 4/yr US$97 (Inst.) $35 (Indiv.)
D. Preidel Publishing Company
101 Philip Drive
Norwell, MA 02061
USA

JESTT (Journal of Education in Science for Trinidad and Tobago)
1974 3/yr
Association for Science Education of Trinidad and Tobago,
c/o Faculty of Education, UWI
St. Augustine, Trinidad.

JOURNAL OF COLLEGE SCIENCE TEACHING
1971 6/yr US$32
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009
USA

JOURNAL OF ENVIRONMENTAL EDUCATION
1969 4/yr US$27
Heldref Publications
4000 Albernarle Street, N.W
Washington, DC 20016

JOURNAL OF RESEARCH IN SCIENCE TEACHING
1964 9/yr US$90 (National Association
for Research in Science Teaching)
John Wiley and Sons Inc.
605 Third Avenue,
New York, NY 10016
USA

JOURNAL OF SCIENCE AND MATHEMATICS EDUCATION IN SOUTHEAST ASIA
1978 2/yr
SEAMEO Regional Centre for Education
in Science and Mathematics,
Glugor, Penang,
MALAYSIA.

MATHEMATICS IN SCHOOL
1972 5/yr. L17.50
(The Mathematical Association)
Longman Group UK Ltd.,
6th Floor, Westgate House, The High,
Harlow, Essex CM20 1NE
ENGLAND

SCHOOL SCIENCE AND MATHEMATICS
1901 12/yr US$22 (Inst.); $19 (Indiv.)
School Science and Mathematics Association
126 Life Science Bldg.,
Bowling Green State University,
Bowling Green,
Ohio 43403,
USA

SCIENCE EDUCATION
1916 5/yr US$54
John Wiley and Sons Inc.
605 Third Avenue,
New York, NY 10016
USA

15.

CONFERENCES

Science Education Conferences held in the Caribbean during the period 1963 to 1987.

CONFERENCE ON MATHEMATICS IN SECONDARY SCHOOLS
(1963 August 7-16: St. Augustine, Trinidad)

Jointly organised by the Mathematical Association of Trinidad and Tobago and the University of the West Indies, the Conference brought together mathematics teachers from 9 West Indian countries and from Venezuela to discuss the new mathematics, its meaning and techniques by which it should be introduced into secondary schools.

MATHEMATICS STUDY CONFERENCE
(1966 December 7-17: St. Lucia)

The conference was attended by 21 persons including mathematics tutors from 5 Teachers' Colleges in the Eastern Caribbean, mathematics teachers and educators. Its aims were to develop a new syllabus for the Teachers' Colleges and define the contents adequately; to ensure that mathematics tutors have common ideas about the content and method defined in the new syllabus; to arrive at a format, content and aims of a common examination paper in mathematics for the colleges; and to ensure that the course in mathematics extended over the whole college course and was given equal time-table rating with Education and English.

CARIBBEAN SEMINAR ON CURRICULUM AND TEACHER TRAINING
(1967 August 29 - September 6: St. Augustine, Trinidad)

Sponsored jointly by UNESCO, UNICEF and the University of the West Indies, the seminar was convened to examine the primary school curriculum reform in relation to the training of teachers; basic problems in teacher education including teacher supply; and areas of teacher education which require international aid through integrated schemes. The seminar was attended by specialists from 14 Caribbean countries.

COMMONWEALTH SPECIALIST CONFERENCE OF MATHEMATICS IN SCHOOLS
(1968 September 2-14: St. Augustine, Trinidad)

The conference was attended by 94 delegates from 29 countries and territories of the Commonwealth. Its aims were to survey current practice in school mathematical education at primary and secondary level, both in teaching methods and procedures and in content; consider the principles on which contemporary courses should be planned and executed for the different levels of children's development and abilities; examine problems which must be met if courses are to be appropriate to the differing

cultural, scientific and economic needs of the countries concerned.

CONFERENCE OF MINISTERS OF EDUCATION AND THOSE RESPONSIBLE FOR THE PROMOTION OF SCIENCE AND TECHNOLOGY IN RELATION TO DEVELOPMENT IN LATIN AMERICA AND THE CARIBBEAN
(1971 December 6-15: Caraballeda, Venezuela).

The conference was convened by UNESCO, in co-operation with ECLA and OAS with the following objectives: to review the progress made in education since a 1966 conference relating to education and economic planning; consider the reform and democratization of secondary education with reference to the development of science teaching; identify regional co-operation needs with regard to higher education especially in science, technology and agriculture; and examine proposals for regional integration in the fields of UNESCO's competence.

CONFERENCE OF MATHEMATICS IN THE JUNIOR SECONDARY SCHOOLS IN TRINIDAD AND TOBAGO
(1972 July: St. Augustine, Trinidad)

Jointly organised by UNESCO and the University of the West Indies, this conference brought together teachers involved in the teaching of the 10-15 year level. Material for use in the first year of the Junior Secondary Schools was developed. In-service training of the first group of teachers in these experimental schools commenced.

THE FIRST NATIONAL CONFERENCE ON SCIENCE EDUCATION.
(1972 December 2nd: Organised by the Association of Science Teachers in Jamaica)

This conference was aimed at increasing communication between the various organisations interested in science education and at attempting to crystallise ideas about the broad objectives of the Jamaican Science Education Programme.

INTEGRATED SCIENCE AND TEACHER EDUCATION
Caribbean Science Educators Workshop
(1973 October 1-13: Hasting, Barbados)

A major objective of this workshop was to provide an opportunity for an exchange of information among science educators engaged in introducing and implementing an integrated science curriculum in countries throughout the region. Organised jointly by UNESCO and CEDO and attended by delegates from 13 Caribbean countries, the workshop emphasised teacher education for integrated science teaching and the production of materials for teacher training courses.

CONFERENCE ON SCIENCE EDUCATION
(2nd: 1973 November 23-24: Jamaica)

Organised by the Association of Science Teachers in Jamaica, the conference investigated the use of local resources in the development of science curricula relevant to the needs of Jamaica.

STANDING CONFERENCE ON TEACHER EDUCATION IN THE EASTERN CARIBBEAN
(3rd: 1967 April 3-5: St. Vincent)
(4th: 1968 April 21-24: Antigua)
(5th: 1969 April 14-17: St. Lucia)
(6th: 1970 April 6-9: Montserrat)
(7th: 1971 April 19-23: St. Kitts)
(8th: 1972 April 10-14: Dominica)
(9th: 1973 April 30 - May 4: Barbados)
(10th: 1974 April 16-20: St. Vincent)
(11th: 1975 April 7-10: Grenada)

Series of standing conferences held under the auspices of the Institute of Education of the University of the West Indies, aimed at clarifying concepts in teacher education and planning detailed action accordingly. Includes reports on curriculum development projects in mathematics and science.

TEACHERS' COLLEGE SCIENCE CURRICULUM WORKSHOP
(1975 July 7-11: Cave Hill, Barbados)

The workshop sought to evaluate the impact of UNESCO project RLA 142 on science teaching in colleges of education; review the material produced by the project and establish how it is used in various colleges; and produce booklets and a general introduction to the programme. In addition, participants viewed videotapes and discussed their utility in science education programmes. Plans for future meetings of science tutors were discussed.

REGIONAL WORKSHOP ON INTEGRATED SCIENCE TEACHING IN LATIN AMERICA
(1975 November 17-28: Montevideo, Uruguay)

The workshop was convened by UNESCO, to exchange information on current projects and programmes in integrated science teaching in Latin America; to consider problems affecting the successful implementation of these programmes; to develop examples of resource materials which may be used as models in the development of integrated science curricula; and to consider means for regional collaboration. Presentations were made on such themes as the evaluation of integrated science curricula, use of low-cost materials, and teacher training in integrated science.

REGIONAL CONFERENCE ON CARIBBEAN INTEGRATED SCIENCE CURRICULUM
(1975 December 15-20: Barbados)

This conference made recommendations for Caribbean Integrated Science Curriculum.

SEMINAR ON SCIENCE EDUCATION PROJECTS IN CARIBBEAN COUNTRIES
(1976 June 27 - July 3: Kingston, Jamaica)

The seminar was sponsored by the Organisation of American States (OAS) with a view to bringing together science educators from English, Spanish and Portuguese-speaking countries of the Americas. Specifically the Seminar sought to gather information on the status of 5 PREDE projects on science education going on in Jamaica, Trinidad and Tobago and Barbados; identify possible areas of co-operation among the projects; promote co-ordination with similar projects going on in Latin America; and assess the degree of integration obtained in the teaching of science in the Caribbean.

COMMONWEALTH REGIONAL SEMINAR/WORKSHOP ON LOW-COST SCIENCE TEACHING EQUIPMENT
(1976 November 16-26: Nassau, Bahamas)

The Seminar was organised to complement the publishing efforts of the Commonwealth Secretariat in the field of science equipment. It emphasised the means of making the knowledge of science available to as many pupils as possible, through local production of low-cost equipment. Delegates from 14 Caribbean countries attended the seminar which included practical laboratory sessions conducted by consultants from the National Council of Educational Research and Training (India), the Science Equipment Production Unit (Kenya) and the Science Curriculum Development Centre of the University of Sierra Leone. Recommendations were made regarding Regional and Commonwealth co-operation.

IN-SERVICE TEACHER EDUCATION IN THE CARIBBEAN
Commonwealth Regional Workshop
(1977 April 19-28: Barbados)

This workshop was organised by the Commonwealth Secretariat and was aimed at helping member countries to develop their in-service teacher training in a manner that will help them to meet their most urgent needs in teacher education. The theme was "Towards an Overall Strategy for Teacher Education".

REGIONAL PRIMARY SCIENCE CONFERENCE
(1978 January 6-12: Cave Hill, Barbados)

This conference represented the first regional effort to review recent developments in science education at the primary level and was organised by the Caribbean Regional Science Project with funding from the British Council. Its aims were to provide a forum for the interchange of ideas on the development of curricula in science at the primary level, either 5-11 years old or 5-14 years in all-age primary schools; design strategies for the renewal of curricula in science for the primary school; evaluate the implications of developments in primary science curricula on teachers' college programmes and secondary school science curricula; determine strategies for teacher re-orientation, establish the need for resource materials, and assess future developments.

SCIENCE EDUCATION FOR PROGRESS
A Caribbean Perspective Regional Conference
(1979 April 19-22: Christ Church, Barbados)

The Conference was convened by the United States National Science Teachers Association (NSTA), Caribbean Regional Organisation of Associations for Science Education (CROASE) and the International Council of Associations for Science Education (ICASE). Its aims were: to bring together science educators from the Americas and the Caribbean, examine the work of science teacher associations in developing and implementing science curricula, to provide an exchange of ideas and experiences between Caribbean science educators and their counterparts abroad and to promote regional and international co-operation in science teaching and curriculum development.

LATIN AMERICAN REGIONAL WORKSHOP IN ENVIRONMENTAL EDUCATION
(1979 October 29 - November 7: San Jose, Costa Rica)

The second of a series of regional workshops organised by UNESCO for teacher educators, curriculum developers, supervisors, educational planners and administrators. Participants from 20 countries attended, including Cuba, Dominican Republic and Haiti. Discussions and working groups were devoted to alternative ways and means for planning and developing environmental education at the national level; strategies for incorporating the environmental dimension into teacher training and into primary and secondary curricula and materials.

SUBREGIONAL TRAINING WORKSHOP ON ENVIRONMENTAL EDUCATION FOR THE CARIBBEAN
(1980 June 9-20: Antigua)

The workshop was organised by UNESCO as a follow-up to recommendations of the Tbilisi Intergovernmental Conference. Its

main focus was the consideration of 3 papers on strategies for developing environmental education at the national level in the Caribbean, including strategies for curriculum development and teacher education. Nineteen participants from 10 Caribbean territories attended the workshop.

CARIBBEAN EDUCATIONAL RESEARCHERS MEETING
Sponsored by the Research Review and Advisory Group of the International Development Research Centre
(1981 January 14-16: Barbados)

The objectives of this meeting were:-

(i) To bring Reseachers in the English-speaking Caribbean together to explore the possibilities of establishing linkages between them;
(ii) To identify the major constraints in doing research and using the results in this region;
(iii) To identify available resources, and explore possibilities with funding agencies;
(iv) To discuss and examine papers produced under the auspices of the Research, Review and Advisory Group concerning research capacity and also the research process;
(v) To explore with policy-makers, ways in which educational research in the Caribbean can more effectively serve the policy-making process.

CONFERENCE ON EDUCATIONAL RESEARCH IN THE REPUBLIC OF TRINIDAD AND TOBAGO: An Exploration of Needs and Approaches : St. Augustine, Trinidad, 1981 July 20-23.

This conference explored the needs and approaches in educational research in Trinidad and Tobago. Different perspectives on educational research were examined and different approaches identified.

CASTME CARIBBEAN REGIONAL SEMINAR
(1982 April 19-23: Barbados)

The seminar was organised by CASTME (Commonwealth Association of Science, Technology and Mathematics Educators) to promote greater awareness of the social significance of science, technology and mathematics education with special reference to the Commonwealth Caribbean. Specifically, the seminar focussed on alternative energy sources, mathematics as a tool for community transformation and new technology and distance learning. Delegates from 11 Caribbean countries attended the seminar.

CONFERENCE OF CARIBBEAN MATHEMATICS TEACHERS
(1st: 1982 October 18-21: Paramaribo, Suriname)

The Conference theme was "Mathematics for the Benefit of the Caribbean Communities and its Reflection in the Curriculum". Caribbean participants came from the Cayman Islands, Curacao, the Dominican Republic, Jamaica and St. Vincent. One of the recommendations of the Conference dealt with the establishment or expansion of existing resource centres to facilitate the exchange of curriculum development materials and research findings in the area of mathematics education.

BIENNIAL EASTERN CARIBBEAN STANDING CONFERENCE ON TEACHER EDUCATION
(1st: 1977 April 18-22: Cave Hill, Barbados)
(2nd: 1979 April 23-27: Cave Hill, Barbados)
(3rd: 1981 April: Cave Hill, Barbados)
(4th: 1983 April 13-15: Cave Hill, Barbados)

Formerly the Standing Conference on Teacher Education in the Eastern Caribbean. Workshops in Education, Educational Administration, English, Mathematics and Science have been held.

SUBREGIONAL WORKSHOP ON TEACHER TRAINING IN ENVIRONMENTAL EDUCATION FOR THE CARIBBEAN
(1983 July 18-29: Mona, Jamaica)

Nine teacher educators from the Bahamas, Barbados, Belize, Dominica, Grenada, Jamaica, St. Lucia, St. Vincent and Trinidad and Tobago, participated in this workshop, which was organised by the School of Education (Mona) in co-operation with the UNESCO-UNEP International Environment Education Programme. Principal goals of the workshop were the exchanging of information and experience on the development of environmental education (EE) in the Caribbean; familiarising participating teacher educators with the contents of the series of 5 teacher training modules in EE prepared by UNESCO; and exploring efficient ways for local adaptation and use of the modules in the Caribbean.

CARIBBEAN CONFERENCE ON PHYSICS
(1st: 1976 May 17-21: Mona, Jamaica)
(2nd: 1984 January 9-13: Cave Hill, Barbados)

The Conference was conceived to promote interaction between researchers in the different campuses of the University of the West Indies, to analyse their different fields of interest and co-ordinate complementary activities; to promote collaboration between the three physics departments; to study ways of integrating with universities in other OAS countries; and to promote discussions concerning academic and social activities that interact with physics.

WORKSHOP ON FOOD AND NUTRITION IN PRE-SERVICE PRIMARY TEACHER TRAINING FOR JAMAICA AND BELIZE
(1984 July 16-19: Mona, Jamaica)

The workshop was convened by the School of Education (Jamaica) for teacher educators and officers from Ministries of Education who have responsibility for curriculum development and review in schools. The objectives were to review the food and nutrition components of teacher training curricula in relation to primary school curricula; develop suitable approaches for the presentation of the food and nutrition content of the college curricula; develop detailed content by subject area for the teaching of food and nutrition in pre-service teacher training; and identify training and other needs to support the implementation of teacher training curricula.

RESOURCES FOR SCIENCE TEACHING
(1984 October: Valsayn, Trinidad)

Organised by ASETT, COSTED and the Ministry of Education and sponsored by the Commonwealth Foundation, the workshop sought to identify the need for computers in educational institutions in Trinidad and Tobago.

INTER-AMERICAN SEMINAR ON SCIENCE EDUCATION
(1984 December 10-14: Panama City, Panama)

The general theme of the seminar was "Science Education and Cultural Environments in the Americas". This was explored through four sub-themes: children's cultures, cognition and science learning; theories, goals and strategies for teaching science; developing effective science programmes; and educating teachers to teach culturally diverse youth. The conference served as a basis for exchange of information, philosophies and research regarding the relationship among culture, cognition and science learning.

INTERNATIONAL CONFERENCE ON ENVIRONMENTAL EDUCATION
(1985 March 4-9: New Delhi, India)

This conference discussed global issues of environmental education. The role of the English-speaking Caribbean with regards to the present status of the environment of this region was also discussed.

OUT-OF-SCHOOL ACTIVITIES IN SCIENCE AND TECHNOLOGY FOR YOUNG PEOPLE: Subregional Seminar/Workshop
(1985 April 23-26: Kingston, Jamaica)

Organised by UNESCO and the Jamaican Society of Scientists and Technologists, the workshop was attended by 65 participants from Jamaica, Bahamas, Barbados and Trinidad and Tobago.
The objectives of the workshop were: to review the UNESCO "Manual for the Promotion of Scientific and Technological Activites for Young People"; prepare plans for integrating and maintaining school-based science clubs; prepare plans for organising a science club and/or any other appropriate activities identified by the workshop and identify strategies for popularising science and technology at the community level.

SCIENCE WRITING WORKSHOP
(1985 July 1-15: St. Augustine, Trinidad)

Organised by COSTED/UNESCO, the workshop aimed at acquainting participants with communication theory and providing them with techniques to improve their science writing skills.

CARIBBEAN WORKSHOP ON THE PRODUCTION OF LOW-COST SCIENCE EQUIPMENT
(1985 August 19-27: Georgetown, Guyana)

Workshop organised by UNESCO to provide opportunities for participants to design and construct items of science equipment using locally available materials; and to allow participants an opportunity to share ideas with respect to providing equipment for science teaching at low cost. The workshop was attended by science educators from 10 Caribbean countries.

THE PROBLEMS OF SCIENCE POPULARISATION IN THE CARIBBEAN (Seminar/Workshop)
(1985 October 8-11: Port-of-Spain, Trinidad)

The workshop was sponsored by UNESCO, the Caribbean Council for Science and Technology (CCST) and the Committee on Science and Technology in Developing Countries (COSTED) and organised by the Caribbean Industrial Research Institute (CARIRI). The aim was to define the need and to discuss the media available for the popularisation of science in the Caribbean. Participants were presented with information on science popularisation in the Caribbean and case studies of its application in support of primary and secondary science teaching. Mechanisms for science popularisation (video, environmental education, radio broadcasts, drama, science fairs, extended learning systems) were also explored.

REGIONAL CONSULTATION ON SCIENCE EDUCATION RESEARCH IN LATIN AMERICA AND THE CARIBBEAN
(1986 February 12-15: Port-of-Spain, Trinidad)

The conference was organised by the Faculty of Education of the University of the West Indies, St. Augustine, COSTED, Ohio State University and NARST to provide an opportunity for interaction of personnel involved in science education research, discussion of science education research findings and their applications, formulation of a policy for future co-operative research activities by science education researchers in Latin American and the Caribbean; discussions with international science education researchers on the application of science and technology to education problems in developing countries and the acquisition of new research skills.

PRIMARY SCIENCE TEACHER TRAINING USING THE PROCESS APPROACH: PHASE 1 WRITING WORKSHOP
(1986 December 1-5: Liverpool, England)

Planning workshop for the Commonwealth Secretariat/UNESCO Primary Science Teacher Training Project, organised by the Commonwealth Secretariat and the University of Liverpool. The aims of the workshop were: to produce materials for use in teacher training courses in a range of developing countries; to convey in these materials an approach to learning science through first-hand experience and investigation, using process skills; to exemplify this approach in the preparation of trainers for using the materials in their courses; to provide guidance for teacher trainers in the use of these materials; and to plan a training workshop in which the materials would be used. Caribbean participants came from Trinidad and Tobago and St. Vincent and the Grenadines.

PRIMARY SCHOOL SCIENCE TEACHING AND SCIENCE FAIR WORKSHOP
(1987 March 15-19: Jamaica)

The workshop was organised by ASTJ, COSTED, IDRC AND OAS for teachers of Primary and Lower Secondary levels:

- to explore and articulate the role and function of science and technology education in future human needs.
- to develop strategies for infusing science and technology into existing science curricula.
- to articulate Grades 1 to 9 science programmes with the Caribbean Examinations Integrated Science courses in Grades 10 and 11.
- to examine information and experiences in relation to the designing of Science Fairs for the attainment of national goals.

AGRICULTURAL EDUCATION IN THE CARIBBEAN AND ITS SOCIO-ECONOMIC IMPACT
(1987 June 22-25: Port-of-Spain, Trinidad)

First conference of the Harland Society of the University of the West Indies (St. Augustine). The objectives of the conference were to appraise the agricultural development process in the Caribbean and the contribution made by agricultural education. Among topics covered were: the role of agricultural education in accelerating development and technological change in agriculture; the role of women in Caribbean agricultural education; the nature of the curriculum environment; facilities required for agricultural education; and reflections on University level training.

INTER-AMERICAN CONFERENCE ON MATHEMATICS EDUCATION
(5th: 1979 February: Campinas, Brazil)
(6th: 1985 November 23-27: Guadalajara, Mexico)
(7th: 1987 July 12-16: Santo Domingo, Dominician Republic)

The sixth conference was organized by the Inter-American Committee for Mathematics Education with the support of UNESCO. Nearly 200 mathematics educators from 24 countries discussed four main themes: historical and cultural aspects in the teaching of mathematics, changes in mathematics teaching due to calculators and microcomputers, mathematical modelling and problem-solving; and identification of causes of failure in school mathematics.

INTERNATIONAL SEMINAR ON PRIMARY SCIENCE TEACHER TRAINING
(1987 August 31 - September 9: Barbados)

Organised by the Commonwealth Secretariat and UNESCO, the seminar aimed to:

i) focus on ways in which primary school teachers can be more effectively trained to teach science;
ii) provide participants with experiences relating to process-based learning in science and establish practical procedures for implementing this approach i: teacher training programmes;
iii) make recommendations concerning those elements of teacher training that are required in effective primary science education;
iv) establish follow-up procedures in order to continue the development and wider dissemination of materials and ideas associated with the Commonwealth Secretariat, UNESCO, ICSU-CTS and ICASE initiatives in primary science education.

SCIENCE TEACHER ASSOCIATIONS

INTERNATIONAL COUNCIL OF ASSOCIATIONS FOR SCIENCE EDUCATION (ICASE)

Current President: Dr. W. King
University of the West Indies
Cave Hill
Barbados

ASSOCIATION FOR SCIENCE EDUCATION OF TRINIDAD & TOBAGO (ASETT)
C/o Faculty of Education
University of the West Indies
St. Augustine
Trinidad

Contact : Ms. J. George

ASSOCIATION OF SCIENCE TEACHERS OF JAMAICA (ASTJ)
The Secretary
ASTJ
P.O. Box 128
Kingston 6
Jamaica

Contact: Ms. F. Commissiong

DOMINICA ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE EDUCATION (DAASE)
St. Joseph Campus
St. Joseph
Dominica

Contact: Mr. Tyrone Norville

ST. LUCIA ASSOCIATION FOR SCIENCE EDUCATION (SLASE)

CAMDU
C/o Teachers' Training College
The Morne
Castries
St. Lucia

Contact: Ms. Marie Grace Auguste

ST. VINCENT ASSOCIATION OF SCIENCE TEACHERS
C/o St. Vincent Teachers' College
Kingstown
St. Vincent

Contact: Mr. Elmor Edwards

17.

SCIENCE CURRICULA

Primary Science in the Caribbean evolved from a state of non-existence to one where Nature Study and Health Science were taught and has now reached the stage where General Science/Integrated Science is taught. Emphasis has shifted from rote memorisation of facts to learning by active involvement with materials. The following lists the topics covered in some islands in the Caribbean.

PRIMARY SCIENCE SYLLABUS IN CARIBBEAN ISLANDS

1. JAMAICA

Grade I 5-6 years

Shapes, Sizes, Texture
Mass
Colour
Heat
Senses and Observation
Grouping Animals
Investigating paper
Investigating string
Investigating leaves
Investigating springy materials
Investigating floating and sinking
Investigating trees
Investigating living animals
Investigating germinating seeds
Measurement

Grade II 6-7 years

Investigating balloons, plastic bags, paper bags, bubbles
Measurement
Setting up an aquarium
Investigating cloth materials
Investigating pipes or tubes in the environment
Investigating flowers, fruit, seeds, shells, bottles, mirrors
Investigating feet of animals, shadows, hair and fur
Growing plants without seeds
Soil, birds
Coconut fruit
Metals, magnets
Investigating tails, wheels, balance
How animals move

Grade IV 8-9 years

Plants, Soil, Rocks
Levers and pulleys
Machines
Gravity and Weight
Balance
Floating and sinking
Effect of gravity on objects on the earth, in space.

Grade V 9-10 years

Variations in objects and persons
Measurement
An investigation of things hot and cold
Conductors, Insulators, Temperature Variation
Fire
Fuel, Wheels, Magnets
Electricity, wind, friction
Our bodies get tired.

Grade VI 10-11 years

Sounds
Pictures
Eyes, sight
Camera
Light
Colours
Plants and animals need light
Individual project

2. ANTIGUA, DOMINICA, MONTSERRAT, ST. VINCENT

The programme used in these islands was developed by the Faculty of Education, at Cave Hill, and covers the following core with variations in keeping with diffferences in local ecology and other requirements:

Age Range: 5-7 years

Movement
Senses and Observation
Materials in the home
Things around us
Measurement

Health and Safety
Earth and Universe
Useful Plants and Animals
Weather

Age Range: 7-9 years

Plants and animals
Health and safety
Earth and Universe
States of Matter
Weather
Energy
Electricity
Pollution and conservation

Age Range: 9-11 years

The body and how it works
Man and his environment
Reproduction
Energy and its uses
Drugs: Use and abuse
Weather
Forms of Energy, work and simple machines.

3. ST. KITTS/NEVIS AND ST. LUCIA

The primary science programme in these islands was developed by the UWI/USAID Project. The USAID project also developed materials for Belize and Barbados. The following lists the topics prepared for the 9-11+ year range.

Electricity
You
Keeping clean
Chemistry in the home
Making things move
Plastics
Materials around us - I
The sky above
Movement in Living things
Animals with wings
Materials around us - II
Energy - Beginning and end
More about weather
Soils and Living things
Measurement

4. TRINIDAD AND TOBAGO

The following lists the process and content covered in the Science - A Process Approach in Trinidad and Tobago (SAPATT) curriculum.

Year I

Perception of Colour
Colour, shape, size, texture
Temperature variation
Perception of sound

Space/Time Relationships

Recognising and using shapes
Recognising direction
Basic shapes in nature
Observing Movement

Classifying

Leaves, nuts or shells
A nature corner

Year II

Colour Change
Solids to liquids
Perception of Odour
Perception of Taste
Seed Germination
The Heart Beat

Space/Time Relationships

Spacing arrangements

Classifying

A purpose for classifying
Classifying animals
Care, treatment and observations of pets

Year III

Observing

The weather
Magnets
The Effect of Environmental Change on Living Things
Protective colouration

Insects

Space/Time Relationship

Two and three dimensional shapes and nature
Time measuring devices

Classifying

Single stage system for classifying living and non-living things
Fruits and Seeds
Pollution, classification and origin
Variation in objects of the same kind
Living and non-living things

Communication

Making graphs for growing plants
Identifying an object
Investigating siphons
Movement in plants
Simple collisions
Physical changes

Year IV

Observing

Animal responses to stimuli
Animals in motion
What growing plants need
Eyes for seeing

Measuring

Thermometers
Making a balance
Measuring forces with springs
Investigating a dripping tap

Classifying

Separating materials from mixtures
Floating and sinking
Living things in aquarium
Parts of a plant
The Environment "A Field Trip"
Solid, liquid, and gaseous states of matter

Communicating

Life cycle
Shadows

Graphing data
Food chains

Inferring

Characteristics of packaged articles

Predicting

Using graphs

Year V

Observing

The effect of running water on the earth's surface
Transferring solar energy
Solutions
Air occupies space
Muscles in pairs

Measuring

Using thermometers

Classifying

Hard and soft water

Communication

The effect of changes of environmental factors on plants
Need for water in plants
Heat and energy

Inferring

Mystery boxes

Predicting

The effect of temperature on dissolving time
Temperature change

Defining Operationally

Floating and Sinking
Living things

Year VI

Observing

Magnetic poles

Light energy
Ears for hearing
Machines at work
Flowers and fruits
Falling objects

Measuring

Describing and representing forces
Evaporation of water

Classifying

Gross physical analysis of soils
Communicating

Simple food webs
Using maps
From seeds to plants

Inferring

Distinguishing between observations and inferences
Loss of water in plants

Predicting

Bouncing balls

Year VII

Observing

Decay

Measuring

Volume of liquids
Measuring volume of solids

Classifying

Classifying animals

Inferring

Inferring connection patterns in electric circuits

Defining Operationally

Parts of a flower
Electric circuits and their parts

Inferring Data

Measuring volumes and masses of solids

Formulating Hypotheses

Formulating hypotheses

Controlling Variables

Upward movement of liquids in materials
Growth of mould on bread

Experimenting

Detritus
Soil fertility
Experimenting.

SECONDARY SCIENCE

At Secondary Level most teaching tends to be geared to the final exam, which in the early 80's changed from the G.C.E. to the C.X.C. Territories which take part in C.X.C. examinations are Anguilla, Antigua/Barbuda, Barbados, Belize, the British Virgin Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts/Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and Turks and Caicos Islands.

CURRICULUM PROJECTS

UNESCO/UWI/UNICEF/Project/RLA/142: Junior Secondary Teacher Training and Curriculum Development

Span: 1970-1975

The broad purpose of Project RLA/142 was to expand and assist in improving the existing facilities for teacher education and curriculum development with respect to pupils at the 10-15 year age level, within 15 Commonwealth Caribbean countries.

In 1973, the Project's inputs were indentified with national efforts to increase the flow of specialised teachers in Language Arts, Mathematics and Science. The main line of support was through the in-service traning of teacher educators in the development of specialised curricula and teacher training programmes in these fields.

Project documentation in Mathematics and Science include the following:

BROADWELL, C (1972) UWI/UNESCO Science Syllabus Workshop final report. St. Augustine.

COLLINS, A, ed. (1972). Proposed syllabus and curriculum guide in the teaching of mathematics at junior secondary level in teachers' colleges.

IBSTEDT, H. (1973) Energy: A self-instructional self-evaluative, integrated science teacher training unit for Caribbean Teachers' College. 2nd ed.

MACDONALD, T. ed. (1972) Report and working papers for the Conference on Mathematics in the Junior Secondary Schools in Trinidad and Tobago. St. Augustine.

------. (1973) Seminar on Junior Secondary Mathematics in Trinidad and Tobago: Report and working papers. St. Augustine.

WILLIAMS, A. and REAY, J. (1973) Integrated Science and Teacher Education: Workshop of Caribbean Science Educators. Cave Hill.

UWI/USAID PRIMARY EDUCATION PROJECT

Nine Participating Countries - Antigua, Belize, Barbados, British Virgin Islands, Dominica, Montserrat, St. Kitt/Nevis, St. Lucia and St. Vincent and the Grenadines.

Project began in 1980.

The conceptual goal "was to improve the learning environment for the primary school age group (7-11 years) throughout the region."

Two of the nine anticipated outcomes were:

i) New curriculum guides in the language arts, science, mathematics and social studies consisting of syllabic teacher manuals and pupil workbooks which have been tested in the territorial schools and found to be teachable and relevant to the Caribbean region.

ii) Additional teaching aids and materials related to the new syllabic and curriculum units which will assist implementation of modern methods.

The quantity of materials produced is voluminous and the Report of the Terminal Evaluation states that:

> "The ... distinctive characteristic of these excellent materials is their attention to the development of the higher levels of thinking especially in Science and Social Studies. The Curriculum materials are outstanding in their use of activities involving forecasting, estimating, evaluation, analysing, synthesizing, thinking critically and 'creatively', and

experimental problem solving. We also note the exceptionally fine development activities incorporated in the Science and Social Studies curriculum."

The project's impact is significant not only in terms of the quality of the materials produced but the curriculum development model created. This model included teacher training highlighting child centred activity methodologies and improved administration to accomodate this change in emphasis.

The planners and implementors of this project were acutely aware of the fate of similar curriculum projects and involved the governments through the Ministries of Education in its implementation. This strategy "allowed for some degree of direct participation by the Ministries of Education in decision making as well as providing some insurance that project outcomes would be institutionalised. This problem is complex. However, there are plans in hand to address it. If a mutually satisfactory solution is found this will be a major breakthrough for the supply of educational materials especially for the Leewards and Windwards.

CARIBBEAN FOOD AND NUTRITION INSTITUTE

The Caribbean Food and Nutrition Institute produced the following:

i) Nutrition education handbook for supervisors of day care centres and nursery schools

ii) A guide for incorporating nutrition into pre-basic nursing education curricula

iii) Food and nutrition education in the primary schools: a handbook for Caribbean teachers.

CURRICULUM INFORMATION IN SOME ISLANDS

ANGUILLA

Primary Level - The Ministry of Education recently rewrote the General Science Curriculum. The new curriculum is pupil-centered and covers local topics.

The project was UNDP supported and written by Anguillian teachers.

The selective examination at the end of primary school has been abolished, entry into secondary school is now by age.

Secondary Level - In Forms 1, 2 and 3 each student does two (2) Agriculture Science and four (4) Integrated Science periods per week. In Forms 4 and 5 separate science and Integrated Science are taught.

Discussion on a Commonwealth Secretariat project to introduce fisheries in the Agriculture Science syllabus is currently underway.

ANTIGUA/BARBUDA

Primary Level - Mathematics and Science are core subjects.

Secondary Level - Mathematics and Science are core subjects with varying additional courses - (Chemistry, Agriculture & Physics) from school to school.

The Attainment Examination is a national examination taken at the completion of the Junior Secondary School programme which permits continuation of secondary education at Senior Secondary School.

The curriculum prescribed by the Ministry of Education.

BAHAMAS

The educational system of the Bahamas comprises the Ministry of Education, some 226 schools, a Community College and libraries which serve some 700 islands.

The Ministry of Education has responsibility for all educational institutions - 82.7% of all schools are fully maintained by Government while 17.3% are subsidised and are classified as "Independent." Mandatory courses offered in Ministry schools lead to the Bahamas Junior Certificate Examination usually after 9-10 years. This is a national examination and while there is no comparative examination at the Senior High Level, the programmes offered at both Junior and Senior High Levels, are prescribed by a standardised curriculum. External examinations like the General Certificate of Education (London) Ordinary Level, and the Royal Society of Arts Certificate (London) are also offered after 11-12 years. Both funding for research and the facilities for science education research are adequate.

At present the Primary Science curriculum is being revised.

Science Resource Centre

Teachers especially at Primary Level needed a centralised site which they could visit in order to receive support materials and/or guidance for instruction. In May 1975, the Science Resource Centre was officially opened. The objectives of this Centre are to serve as:

1) a site for In-Service Training Workshops for teachers of primary school science;
2) a Science Service Centre (for repair of broken equipment);
3) a Central Supply Centre for the learning of Science materials (kits, audio visual aids, models, chemicals);
4) a Resource Centre for teachers for discussion related to problems encountered in the teaching;
5) a site for demonstration of new science apparatus.

Its services have now been extended to secondary teachers. In 1982 the Ministry of Education developed the following:

Primary Level -

1) Primary Science Syllabus. Nassau. For students from Grades 1-6.

2) Agricultural Science Syllabus. For the primary schools.

Secondary Level -

1) General Science Syllabus: Junior Secondary, Nassau. Three year programme (Grades 7-9) surveying the basic concepts in Biology, Chemistry and Physics.

2) General Science Syllabus: Senior Secondary, Nassau. Curriculum designed for 10th - 12th grade students pursuing vocational subjects.

3) Agricultural Science Syllabus: Nassau. Curriculum guideline for grades 7 - 12.

4) Basic first aid syllabus: grades 6-7. Nassau. Ministry of Education.

5) Health Science Syllabus 1982: Grades 7,8 and 9. Nassau.

6) Junior Secondary Health Science.

7) Senior Secondary Biology

8) Senior Secondary Chemistry ('O')

9) Senior Secondary Physics ('O')

Additionally the following resource materials have been completed and/or are awaiting approval to be printed:-

1) A supplement to the Primary Science

2) A Dictionary of Organisms

3) A Catalogue of Places of Scientific Interest

4) A Laboratory Safety Manual

5) Health Science Workbook

6) Agricultural Science Pesticides Manual

7) Science Resource Materials Catalogue

The Ministry of Education is currently involved in implementing the science curricula in New Providence and Family Islands.

BARBADOS

Primary Level - Mathematics and Science are core subjects. For a short period of time Science was included in the final primary school examination. This is now being reviewed.

Secondary Level - Agriculture, Mathematics and separate sciences.

The curriculum is not provided by Ministry of Education in Primary and Secondary Schools.

BELIZE

There is a Curriculum Development Unit in the Ministry of Education. Its publishing responsibilities are to produce curriculum guides for the primary system and support materials developed by teachers for the curriculum.

In 1984 it was involved in four projects each of which had to produce some form of educational materials.

These are:

1) Relevant Education for Agriculture and Production (REAP). Under the REAP Project the following materials were produced:

   a) nine curriculum guides, each based on a topic of study

   b) the Reap In-Service Guide, setting out the philosophy

and basic methodology to be followed

c) Let's All REAP Together, a manual of Agricultural practices.

2) USAID Primary Education Project (P.E.P.)

3) School Health Education Project (S.H.E.P.)

a) Health and Nutritional Manual for Belize emphasising locally produced foods.

4) Eight comic books for students.

The Curriculum Unit also produces curriculum guides for the primary system and in 1984 produced an Arithmetic textbook.

The Curriculum Development Unit in 1976 developed a Senior Primary Science Curriculum for age group: 10-14 yrs.

BRITISH VIRGIN ISLANDS

Primary Level - Department of Education (1976)
"Primary Science Curriculum Guide (Age group: 5-12 years)"

CAYMAN ISLANDS DEPARTMENT OF EDUCATION (1976)

Primary Science Curriculum Guide (age group: 5-11 years).
Georgetown: Department of Education

DOMINICA

Primary Level - Mathematics and Science are core subjects.

The 11+ Examination selects 25% (+500) of those taking the exam to enter secondary school. Those not successful in obtaining entry to secondary school continue at primary school, entering a Junior Secondary Programme.

In the Junior Secondary Programme science is taught via Mathematics, Health Science, Agricultural Science and Integrated Science. In September 1987 a revised Junior Secondary Science programme is expected to be introduced into the schools.

On completion of the 3-year Junior Secondary Programme, pupils take the National School Certificate exam from which a few excellent students may be accepted into 4th forms of Secondary School.

Secondary Level - Science subjects offered are: Physics, Chemistry, Biology, Integrated Science and Mathematics. Core subjects vary from school to school but all schools require their students to do English and Mathematics.

Post Secondary - The two post secondary institutions are:

1) Clifton Dupigny Community College (CDCC)
2) Dominica Teachers' College.

In CDCC there are two streams:

1) Academic which offers 'A' Level Science Programmes in Mathematics, Physics, Biology and Chemistry.

2) Technical which offers science based programmes in T.V., Radio, Electronic Appliances Servicing, Building Construction, Agriculture, Mechanical/ Electrical Engineering, Automechanics, Plumbing and Electrical Wiring.

GRENADA

Primary Level - Core areas are Mathematics, General Sciences and Agricultural Science

Secondary Level - Broad core areas - Mathematics and Science
Additional Courses - Physics, Chemistry and Agriculture.

The Ministry of Education prescribes the curriculum in Primary and Secondary Schools. A National Curriculum Committee has been established and curriculum changes are being carried out both at Primary and Secondary Levels.

GUYANA

Primary Level - Mathematics and General Science are taught. .

On completion of 11+ students write the Secondary Schools Entrance Examination for placement in one of three (3) categories of the Secondary Education System.

Secondary Level - The three categories of the Secondary Education programme are:-

i) Secondary Departments of Primary Schools
ii) Community High Schools
iii) General Secondary Schools

Science is done up to the Secondary Schools Proficiency Examination (SSPE) Level Parts I and II and G.C.E. O'Levels after 3 years, 4 years and 5 years respectively. C.X.C. is replacing G.C.E. O'Level and General Secondary Schools also teach for G.C.E. A'Levels in Science.

The Ministry of Education, Social Development and Culture developed:-

a) Primary Science Education Programme for Levels 1 and 2 (1977).

b) Primary Science Education Programme for Level 6 (1978).

c) The Upper Primary School Student's booklet entitled, "Everything you ever wanted to know about nutrition but were afraid to ask" (1982).

JAMAICA

Primary Level - Broad subjects: Mathematics, Science
Core area: Mathematics

Secondary Level - Broad core areas: Mathematics, Science

A new curriculum has recently been introduced in the primary grades (Grade 1-6). A common core curriculum is being developed for Grades 7-9.

MONTSERRAT, ST. KITTS/NEVIS, ST. LUCIA, ST. VINCENT

Primary Level - Mathematics, Science Agriculture - broad subjects.

Secondary Level - Mathematics, Science - broad area.
Additional courses: Chemistry, Agriculture Physics and Biology.

SURINAME

Source: Andrew Ucebor: Science education in schools - The Caribbean experience. (1984) (see reference 9047)

Primary Level - The curriculum at the elementary or primary level consists mainly of traditional subjects. Science has not been considered necessary at this stage. During the final year, all pupils take a compulsory general achievement test. The test lays heavy emphasis upon acquisition of knowledge.

Secondary Level - The curriculum at the Middle General Secondary, the academic stream of the Junior Secondary Education, is general, broad-based, and examination oriented. It has two main streams. The "A" steam, which concentrates on the Arts and "B" stream which concentrates on the Sciences, notably Mathematics and Physics. At this stage, science is taught as a special subject to be taken by those who will eventually pursue careers in science. Those opting for stream "A" may complete their secondary schooling without exposure to science.

TRINIDAD AND TOBAGO

Primary Level- At the elementary school level a science curriculum, Science - A Process Approach for Trinidad and Tobago has been developed. This aims at providing students with relevant, effective and hands-on learning experiences using the processes of science; at developing critical thinking and a positive attitude to science and at preparing students for more complex science learning in the secondary school. Teachers' guides have been prepared by curriculum developers from the Faculty of Education, University of the West Indies and the Ministry of Education in conjunction with teachers at curriculum development workshops. These guides contain background information for the teachers, behavioural objectives, activities, material lists and competency measure tasks for students and encourage teachers to integrate the teaching of science with Mathematics, Social Studies and other subjects, and to use inexpensive local materials.

The programme called "Science - a process approach for Trinidad and Tobago (SAPATT): a science curriculum for elementary schools grades 1-6 comprises the following:

A. Teachers' Guides

Teachers Guides	Year	Age
1	1-2	5-6, 6-7
2	3	7-8
3	4	8-9
4	5	9-10
5	6	10-11
6	7	11-12

B. A series of study-workbooks Primary Science for the Caribbean, 1-7, which introduces science in the primary school by a collection of experiences using the process approach.

Student Workbooks	Age
1	5-6
2	6-7
3	7-8
4	8-9
5	9-10
6	10-11
7	11-12

C. A comprehensive practical teachers' manual How to teach primary science in the Caribbean, by R. Douglass and P. Abder (London: Heinemann, 1987).

D. A collection of revision questions for all levels, Success in Common Entrance Science, by P. Abder (London: Heinemann, 1987).

Secondary Level - At the secondary Level, a core curriculum has been designed for Forms 1, 2 and 3. This is an integrated course on a unitary modular plan. Science at Forms 4 and 5 is usually geared to the science syllabuses of the Cambridge Overseas 'O' Level examination (G.C.E.) in the separate subjects. More recently, the Caribbean Examinations Council (C.X.C.) has drawn up its own syllabuses for Physics, Chemistry, Biology, Agricultural and Integrated Science. CXC examinations in these subjects began in 1985. At 6th Form Level Students study for the Cambridge Overseas 'A' Level examinations in Chemistry, Physics, Biology, Botany and Zoology.

Sources used

a) CARNEID Papers
b) Private communication with Ministry of Education and/or the University of the West Indies personnel
c) MacPherson, J. Survey of the preparation publishing and printing of educational material for the Caribbean region. Paper prepared for ECLAC subregional Headquarters for the Caribbean.

SCHOOL POPULATION STATISTICS

ANGUILLA

Number of Schools, Pupils and Teachers, 1987

SCHOOL TYPE	SCHOOLS	PUPILS	TEACHERS
Primary	6	1100+	61
Secondary	1	635	40

Source: R. Jones, Education Advisor to Minister of Education.

ANTIGUA/BARBUDA

Number of Schools, Pupils and Teachers, 1983

SCHOOL TYPE		SCHOOLS	PUPILS			TEACHERS		
			M	F	TOTAL	M	F	TOTAL
Primary	Private	17	1668	1673	3341	10	79	89
	Gov't	31	3585	3007	6592	58	279	337
	TOTAL	48	5253	4680	9933	68	288	426
Secondary	Private	7	527	548	1075	29	59	88
	Gov't	9	1351	1771	3122	82	161	243
	TOTAL	16	1878	2319	4197	111	220	331
Post Secondary		1						

Source: Caricom Statistical Section.

BAHAMAS

Number of Schools, Teachers and Pupils, 1986-87

SCHOOLS

SCHOOL TYPE	GOV'T	PRIVATE	TOTAL
Primary (5-11+)	74	15	89
All Ages (5-16+)	86	10	96
Jr. High (11-14+)	7	9	16
Jr. & Sr. High (11-16+)	14	1	15
Sen. High (14-16+)	8	5	13
	189	40	229

TEACHERS

SCHOOL TYPE	(New Providence)		(Family Islands)		National
	Gov't	Private	Gov't	Private	TOTAL
Primary (5-11+)	672	165	221	10	1068
All Ages (5-16+)	5	140	336	128	609
Jr. High (11-14+)	326	-	12	-	338
Jr. & Sr. High (11-16+)	58	186	264	43	551
Sen. High (14-16+)	340	-	56	-	396
	1401	491	889	181	2962

PUPILS, 1986-87

SCHOOL TYPE	New Providence	Family Islands	National Total
Government	27,196	18,317	59,559
Private	10,624	3,422	

PUPILS, 1985-86

	New Providence				Family Islands			
	Gov't		Private		Gov't		Private	
	Male	Female	Male	Female	Male	Female	Male	Female
Prim.	7465	7333	1954	299	2756	2458	112	127
All Age	26	30	995	1366	4021	3753	1154	1320
Jr. High	3048	2963	-	-	97	106	-	-
Jr. & Sr. High	527	441	1781	2355	2397	2480	192	299
Sr. High	2690	3001	-	-	440	480	95	131
	13806	13768	4730	5740	9711	9277	1553	1877

NATIONAL DATA

	MALES	FEMALES	TOTAL
Primary	12287	11937	24224
All Age	6196	6409	12665
Jr. High	3195	3069	6264
Jr. & Sr. High	4897	5575	10472
Sr. High	3225	3612	6837
			60462

Source: Mr. Ezekiel Stubbs, Ministry of Education.Planning Division,Nassau, Bahamas.

BARBADOS

Number of schools, Pupils and Teachers, 1986

SCHOOL TYPE	NO. OF SCHOOLS	PUPILS	TEACHERS
Nurseries	3		
Infant	5		
Primary (7-11)	99		
Composite (5-16)	11	29,392	1,486
Gov't Sec.	21	21,501	1,196
Privat Asst. Sec.	15	4,227	-
Private	-	3,547	-
Senior (14-16)	7	967	79
TOTAL		59,634	

Source: Mr. O. Douglas, Ministry of Education.

BELIZE

Number of Schools, Pupils & Teachers, 1984

SCHOOL TYPE		Schools	Pupils			Teachers		
			Male	Female	Total	Male	Female	Total
Primary	Private	11	-	-	-	-	-	-
	Gov't	22	-	-	-	-	-	-
	Denomi.	183	-	-	-	-	-	-
	Total	216	19248	18505	37753	425	1090	1515
Secondary	Gov't	6	-	-	-	-	..	-
	Other	16	-	-	-	-	-	-
	Total	22	3035	3497	6532	278	213	491

Source: Caricom. Statistical Section.

BERMUDA
Enrollment by Type of School and Sex, 1983

Government		Private		Bermuda College	
Male	Female	Male	Female	Male	Female
4331	4160	972	935	258	276

Primary Enrollment by Grades, 1983

	Total	M	F	1	2	3	4	5	6	7
Gov't	4394	2241	2153	594	658	644	594	611	621	672
Private	1144	573	571	165	160	162	169	148	166	174

Secondary Enrollment, 1983

	Total	M	F	1	2	3	4	5	6
Gov't	3464	1735	1729	742	752	697	647	626	-
Private	763	399	364	148	145	121	122	199	108

Teachers By School Type & Qualifications, 1983

Qualifications	Total	Secondary	Primary	Special	Nursery
	678	302	281	58	37
Degree: Trained	427	225	158	28	16
Untrained	11	3	3	3	2
Other: Trained	218	74	115	18	11
Untrained	22	-	5	9	8

Source: Bermuda. Statistical Department. Bermuda digest of Statistics 1984. Hamilton: The Department, 1984.

DOMINICA

Number of Schools, Pupils and Teachers, 1987

SCHOOL TYPE	Schools	Pupils			Teachers		
		Male	Female	Total	Male	Female	Total
Primary	66	10375	10400	20775	228	424	652
Secondary	10*	1368	2232	3600			164
Post Secondary	2	-	-	300	-	-	20

* 3 Gov't, 7 Assisted

Source: Rupert Lance, Clifton Dupigny Community College (CDCC) Roseau, Dominica, private communication

FRENCH-SPEAKING CARIBBEAN

STUDENTS IN PRIMARY SECTOR

1984-85

		Guadeloupe	Martinique	Guyane
Pre-school	Public	15,982	17,063	3,985
	Private	1,797	743	594
	Total	17,779	17,806	4,579
Primary	Public	41,689	34,451	8,502
	Private	3,289	1,998	1,201
	Total	44,978	36,449	9,703
Special Students		824	868	592
TOTAL-Primary		63,581	55,123	14,874

STUDENTS IN SECONDARY SCHOOL

1984/85

	PUBLIC		
	Guadeloupe	Martinique	Guyane
First cycle	32,936	31,660	5,463
Second cycle	13,638	12,892	2,855
Total	46,574	44,552	8,318

STUDENTS IN SECONDARY SCHOOL

1984/85

	PRIVATE		
	Guadeloupe	Martinique	Guyane
First cycle	1,945	2,144	542
Second cycle	1,496	2,468	392
Total	3,441	4,612	934

TEACHERS

1982-83	Guadeloupe	Martinique	Guyane
Instituteurs*	3,266	3,534	680

*i.e. Teachers College graduates

1983-84	Guadeloupe	Martinique	Guyane
Professeur*	3,015	3,194	524

*i.e. University graduates

Source: Education Nationale Service Statistique

GRENADA

SCHOOL TYPE	Schools	Pupils			Teachers		
		Male	Female	Total	Male	Female	Total
Primary (Public	58*	10508	9431	19939	244	508	752
Primary (Private	6	NA	NA	Na	-	-	-
Secondary	19	2749	3759	6508	166	147	313
Post Secondary	3						
Adult Education	1						

* 16 Gov't, 42 Denom.

Source: Mr. Wharwood, Ministry of Education, Grenada
Private Communication.

GUYANA

Numbers of Schools, Pupils and Teachers, 1984

SCHOOL TYPE	Schools	Pupils			Teachers		
		Male	Female	Total	Male	Female	Total
Primary	425	63622	70433	144055	1534	2920	4454
Secondary							
i) As Department in Primary Schools	317						
ii) General Secondary	56						
iii) Community High	28						
Total Secondary	401	14043	17426	31469	885	644	1529

Source: Caricom Statistical Section

JAMAICA

Number of Students, Teachers and Schools, 1983-84

	School	Students	Teachers
Primary (5-11)	290	177950	4294
All Ages (Gr. 1-9)	493	237576	6064
Secondary School	79	94593	4503
Sec. High (Prestige)	46	55749	2832
Comp. High	6	7965	350
Tech. High	7	7976	454
Vocational	1	532	54
Private Primary (Kindergarten Prep.)	93	9151	683
Private Secondary	48	4404	NA
	1985	595896	19234

Source: Ministry of Education publication

Teachers By Type of School and Sex, 1984

Infant		Primary		All-Age		New Second		Second High	
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
-	256	386	3873	941	5174	1503	3000	879	1953

Technical High		Compreh. High		Vocational		Independent	
Male	Female	Male	Female	Male	Female	Male	Female
214	213	147	251	30	21	116	5167

Source: Institute of Jamaica. Statistical Abstract 1984 Kingston: The Institute, 1985

MONTSERRAT

School Population by Sex and Type of School, 1982-83

Primary			Jr. Secondary			Secondary			Technical		
M	F	Tot.	M	F	Tot.	M	F	Tot.	M	F	Tot.
874	849	1723	247	222	469	231	171	402	34	32	66
No. of Teachers:		66			32			28			9

Source: Montserrat. Statistics Office. Ninth Statistical Digest 1984 Plymouth: Statistics Office, 1983

	Male	Female	Total
Pupils (All Levels)	1386	1274	2660
Teachers			135
No. of Primary Schools			14

ST. KITTS/NEVIS

SCHOOL TYPE		Schools	Pupils	Teachers
Primary	Gov't	26		
	Total	31	7569	334
Secondary		8*	4615	296

* 6 Gov't Sec.

Source: Mr. Halliday, Ministry of Education

ST. LUCIA

Numbers of Schools, Pupils and Teachers, 1985-86

SCHOOL TYPES	Schools	Pupils			Teachers		
		Male	Female	Total	Male	Female	Total
Primary/Secondary	79	16525	15748	32273	222	862	1084
	12	2414	3251	5665	134	175	309

Source: St. Lucia Government. Annual Statistical Digest 1985-86 Castries

ST. VINCENT

SCHOOL TYPE	Schools	Pupils			Teachers		
		Male	Female	Total	Male	Female	Total
Primary	61	12972	12180	25152	456	808	1283
					105	236	348
Secondary	21	2651	3864	6515	72	72	144
					36	55	91

Source: Ministry of Education

TRINIDAD AND TOBAGO

Number of Schools, Pupils and Teachers, 1984-85

SCHOOL TYPE	Schools	Pupils			Teachers		
		Male	Female	Total	Trained	Trained	Total
Primary	468	86676	85748	172424			7626
Secondary							
Gov't	18	5800	6822	12622	411	372	783
Assist.	28	9315	8261	17576	414	477	891
Jr. Sec.	24	19719	19469	39188	1148	287	1435
Sen. Compr.	19	10354	11260	21614	630	887	1517
Composite	6	1736	1828	3564	73	106	179
TOTAL	95	46924	47640	94564	2676	2129	4805

Source: Central Statistical Office

SUMMARY TABLE

SCHOOL POPULATION STATISTICS

PRIMARY

Country	Schools	Students	Teachers
Anguilla	6	1,100+	61
Antigua	48	9,933	426
Bahamas	89(p)	24224(p)	1068(p)
	96(a)	12665(a)	609(a)
Barbados	99(p)	29392	1486
	11(a)	-	-
Belize	216	37,753	1,515
Bermuda	-	5,538	281
Colombia*	35402	4,337,607	-
Costa Rica*	2944	342,308	-
Cuba	11771	1,409,765	-
Dominica	66	20,775	652
Dom. Repub.	5369	1,033,000	-
Grenada	58	19,938	752
Guadeloupe	-	63,581	3,266
Guatemala*	-	953,400	-
Guyana	425	144,055	4,454
Guyane	-	14,874	680
Honduras*	7000	70,000	-
Jamaica	290(p)	177,950(p)	4,294(p)
	493(a)	237,576(a)	6,064(a)
Martinique	-	55,123	3,534
Mexico*	54000	12,560,000	-
Montserrat	14	1,723	66
Netherland Antilles	-	22,000	-
Panama*	2316	335,239	-
St. Kitts/ Nevis	31	7,569	334
St. Lucia	79	32,273	1,084
St. Vincent	61	25,152	1,264
Suriname	-	74,800	-
Trinidad & Tobago	468	172,424	7,626
Venezuela*	14,749	2,912,136	-

Key: p - primary a - all-age
Source (*) - CCA/UNEP. Directory of environmental education, institutions, programmes and resource people in the Caribbean. Rome: FAO, 1985. (Regional Seas Directories and Bibliographies).

SCHOOL POPULATION CONTINUED

SECONDARY

Island	School	Students	Teachers
Anguilla	1	635	40
Antigua	16	4,197	331
Bahamas	44	23,573	1285
Barbados	43	30,242	1275
Belize	22	6,532	491
Bermuda	-	4,227	302
Columbia*	4607	1,879,118	-
Costa Rica*	201	131,087	-
Cuba	4607	826,477	-
Dominica	10	3,600	164
Dom. Repub.	239	104,557	-
Grenada	19	6,508	313
Guadeloupe	-	50,015	3,015
Guatemala*	-	190,115	-
Guyana	401	31,469	1,529
Guyane	-	9,252	524
Honduras*	2,000	175,000	-
Jamaica	187	171,219	8,193
Martinique	-	49,104	3,194
Mexico*	6,300	1,800,000	-
Netherland Antilles	-	7,000	-
Panama*	190	130,881	-
St. Kitts/ Nevis	8	4,615	296
St. Lucia	12	5,665	309
St. Vincent	21	6,515	233
Trinidad & Tobago	95	94,564	4,805
Venezuela*	1,857	1,012,136	-

Source (*) - CCA/UNEP. Directory of environmental education, institutions, programmes and resource people in the Caribbean. Rome: FAO, 1985. (Regional Seas Directories and Bibliographies.

APPENDIX

RESEARCH IN SCIENCE AND MATHEMATICS EDUCATION IN JAMAICA

BIBLIOGRAPHIC GUIDE

by

JOYCE GLASGOW

A Background Paper Prepared for the Regional Consultation

on

Science Education Research

in

Latin American and the Caribbean

organised by

Faculty of Education
University of the West Indies
St. Augustine, Trinidad & Tobago
February 12 to 15, 1986

THE SURVEY

The studies included have been grouped under the following headings:

1. Reviews
2. Achievement in the Orientation to Science and/or Mathematics
3. Attitude to Science/Mathematics
4. Cognitive Development and Concept Attainment
5. Language and Science Education
6. Methodology for Science/Mathematics Education
7. Provisions for the Teaching of Science
8. Scientific Literacy
9. Curriculum Development and/or Evaluation
10. Nutrition Education
11. Environmental Education

It must be emphasised that the groupings represent only main considerations, where in reality, many studies could carry several descriptors.

1. REVIEWS

LEO-RHYNIE, E. A. (1982) 101

Educational research of some graduate students of U.W.I.: A commentary. Caribbean Journal of Education, 9(2), 135-151.

This paper represents one of the few attempts to review and analyse educational research in Jamaica. The work of a sample of graduate students is examined, to highlight the potential value of the investigations in terms of the understandings they impart, and the directions for improvement they indicate. The sample looked at includes works which address various aspects of science education (Seaton, 1980; Glasgow, Leo-Rhynie, 1978; Hamilton, 1976; Isaacs, P, 1975; Isaacs, 1974).

2. ACHIEVEMENT IN AND/OR ORIENTATION TO SCIENCE AND/OR MATHEMATICS

HAMILTON, M.A. (1976) 201

A study of certain personality, educational and environmental variables associated with science orientation in a selected group of fifth form students in secondary schools of Jamaica. Unpublished Ph.D. thesis, University of the West Indies.

HAMILTON, M.A. (1976) 202

A study of certain personality, educational and environmental variables associated with science orientation, in a selected group of fifth form students in secondary schools of Jamaica. Caribbean Journal of Education 3(3), 227-243.

The study examines the effect of nine personality, eight educational/intellectual and thirteen environmental variables on the science orientation of 576 students as assessed by a measure based on their performance in science in the G.C.E. 'O' level examinations. Space Relations, Socio-economic Status and Type of Student (Arts/Science) were significant predictors of performance for both boys and girls. Other important predictors for girls were Early Educational Experiences, Attitude to Science, Science Teachers Involved, Facilites for Teaching Science. For boys, these included Vocational Aspirations, Abstract Reasoning, Influence of Outstanding Relatives and Authoritarianism. Some of the students sampled who were proceeding to 'A' level and who appeared to fulfill the basic requirements of favourable science orientation, had not opted for science at the higher level, though it was not apparent whether this was by choice or coercion.

HAMILTON, M.A. (circa 1979) 203

The practising Jamaican scientist - a profile. West Indian Science and Technology 4(1), 17-22.

Based on several tests, including ones on science attitude, convergency/divergency, personal adjustment, verbal-spatial-mathematical aptitude, the author presents the patterns emerging from the analysis as a "profile" of the "average" practising Jamaican scientist. Characteristics of this profile include, being the first-born child of a middle class family, high academic performance throughout school and university, high involvement in and satisfaction with his profession and family life as well, and well-adjusted personality.

HAMILTON, M.A. (1985) 204

Performance levels in science and other subjects for Jamaican adolescents attending single-sex and co-educational high schools. Science Education 69(4), 535-547.

Results for 529 boys and 617 girls (14% of the Jamaican High School population) in the G.C.E. 'O' Level examinations were analysed. Boys and girls from single sex schools out-performed their counterparts in co-educational schools for both the total sample, and the sub sample of 337 investigated in greater depth. Significant favourable differences

emerged for geography, chemistry and biology for students in the single sex schools. Girls in this type of school registered the highest grades in chemistry and biology. Possible explanations for these differences are explored.

ISAACS, I. (1974) 205

Some factors related to the performance in mathematics of third-year students in Jamaican post-primary schools. Unpublished M.A. thesis, University of the West Indies, Jamaica.

ISAACS, I. (1975) 206

The mathematical performance of a selected sample of third year students in Jamaican post-primary schools. Caribbean Journal of Education 2(1), 15-23.

Responses of 546 students from third year post-primary schools to a mathematics achievement test designed for them indicated that -

- about 85% of all age, 60% of junior secondary and 20% of high school students in the group were only capable of doing very simple arithmetical computations and using basic algebraic expressions.
- about 15% of all age, 33% of junior secondary and 80% of high school students were capable of mathematical thinking at the levels of comprehension and application.
- students in only one high school could answer satisfactorily items based on "modern" mathematics topics.

ISAACS, I. (1976) 207

Environmental and other factors affecting the performance in mathematics of third year students in Jamaican post-primary Schools. Caribbean Journal of Education 3(1), 51-65.

The study examines the psychological and environmental variables related to mathematics achievement of third year students in Jamaican post-primary schools. A correlational study of the interrelations of thirteen independent variables with the criterion, mathematics achievement, was first analysed to produce four factors which explained most of the variance in performance. These factors were related to (i) social environment of the student; (ii) the student's perception of his ability to do mathematics; (iii) the teachers of mathematics; and (iv) the degree of urbanisation of the school locale.

JAMAICA. MINISTRY OF EDUCATION. RESEARCH SECTION (1985) 208

Mathematics competence of grade 7 students from all-age schools. Research Bulletin, (July).

> Responses from 888 Grade 7 students in 23 all age schools on a 60 item test covering several areas were analysed to explore the effect of school location, content area and grade level of the test items on performance.

LEO-RHYNIE, E.A. (1978) 209

An investigation into the relationship of certain cognitive, environmental, experimental and motivational variables to the academic achievement of selected Jamaican sixth form students. Unpublished Ph.D. thesis, University of the West Indies, Jamaica.

> Performance at 'A' Level was the criterion of achievement used in this study which looked at a sample of 205 Jamaican sixth form students and 75 of their teachers. Among the High levels of performance on field dependence/independence, abstract reasoning and spatial ability contributed to 'A' level success, especially for male students, and for those of either sex pursuing science rather than arts courses. Motivational variables and study habits were more important to performances for the male and science groups than for the influenced student performance.

LEO-RHYNIE, E. (1978) 210

The performance of Jamaican sixth form students in the Cambridge 'A' level examination. Caribbean Journal of Education 5(3), 153-167.

> The article analyses performance across a range of subject areas, points out and suggest reasons for the poor performance at 'A' level of Jamaican students in comparison to their British and Trinidadian counterparts, despite resonable results at 'O' level. For all countries, the percentage pass rate tends to be low for science than for arts subjects. In the Jamaican situation where skills in scientific and technological fields among others, are in short supply, this wastage of the sixth form level demands attention.

MITCHELMORE, M.C. (1974) 211

The perceptual development of Jamaican students, with special reference to visualization and drawing of three-dimensional geometrical figures and the effects of spatial training. Unpublished Ph.D. dissertation, Ohio State University, U.S.A.

In the developmental survey, 80 high-ability students from Grades 1,3,5,7 and 9 of Kingston schools (40 boys and 40 girls) were given a series of individual tests. In the Grade Nine survey, a series of group tests were administered to schools in 3 contrasting environments. In the spatial training experiment, 6 first-year and 8 second-year classes of prospective elementary school teachers, were randomly divided into 2 groups; one group studied a 4-week individualised unit in which they designed, constructed and sketched models of elementary 3D shapes, while the other group studied a control unit on statistics. The 3 group tests were used to measure changes in spatial ability. Among the findings of the study are: spatial ability develops earlier in boys than girls, among high-ability Jamaican school children; high school students scored significantly higher than technical high school students, who in turn scored significantly higher than junior secondary and all-age students; spatial ability was not related to skin colour, handedness or eye dominance; and, there are no significant age trends or sex differences in illusion susceptibility.

MITCHELMORE, M.C. (1982) 212

The Cooperative Geometry Research Project. Mona, Jamaica: School of Education, University of the West Indies.

The report details a project in which 20 third-year students from two rural teachers' colleges in Jamaica carried out a co-ordinated set of individual investigations into children's learning of geometrical concepts. All studies which covered Grades 2-10, included some initial testing of children's knowledge of a selected topic, teaching of an experimental unit on that topic, and a post-test. Pre-testing revealed that the majority of pupils knew very little about geometry: triangles were known to only 60-70% of Grade 2-3 pupils and no Grade 4 pupil could identify the centre of a circle. However, poor performances was attributed largely to lack of exposure to geometrical ideas, as most primary school teachers accorded the subject very low priority. The project reported overwhelming evidence that pupils could acquire concepts easily if these were introduced using an almost entirely concrete approach. Linguistic difficulties were also found to impede demonstration of mathematical understanding.

PARRIS, D.J. (1981) 213

An investigation into the relationship of certain variables to the science achievement of a selected group of Jamaican fifth form students. Unpublished M.Ed. dissertation, University of the West Indies, Jamaica.

The study sought to examine 'O' Level performance of a sample of 567 fifth form students to compare overall performance

with performance in science subjects; to see if there were differences in attainment of boys and girls and between urban and rural students; to identify factors affecting science achievement; and to identify the best predictors of 'O' Level science achievement. The major factors which emerged were: a school resource factor 1 for the total sample and the urban/rural and male sub-samples; a school resource factor 2; a socio-economic factor for all groups; and a factor related to academic achievement and aspirations. Overall performance was significantly better for girls but boys did better in science; urban students performed better than rural students, overall and in science; the importance of the school in affecting science was clearly demonstrated.

ROACH, D.A. (1978) 214

The effect of cognitive style and other related variables on the achievement in mathematical of some Jamaican elementary school children. Unpublished Ph.D. dissertation, University of the West Indies, Jamaica.

The study examined the effect of cognitive style and other related cognitive, physical and social variables on achievement in mathematics. The sample comprised 206 boys and 212 girls from grade 6 in five elementary schools in Kingston, Jamaica. The following variables were found to be significantly related to achievement in mathematics: field dependence, conceptual style preference, mental ability, reading achievement, family size, sex, occupational level and birth order.

ROACH, D.A. (1979) 215

The effects of conceptual style preference, related cognitive variables and sex on achievement in mathematics. British Journal of Educational Psychology, 49, 79-82.

The Conceptual Style Test, a mathematics achievement test and an intelligence test were administered to grade 6 children, 206 boys and 212 girls, in 5 urban Jamaican elementary schools. Mathematics achievement had significant positive correlations to analytic conceptual style and intelligence; girls had higher mathematics achievement than boys. Analytic conceptual style had a significant positive correlation with intelligence, but had no relation to sex. When intelligence was partialled out, the relation between conceptual style preference and mathematics achievement became non-significant.

ROACH, D.A. (1981) 216

Predictors of mathematics achievement in Jamaican elementary school children. Perceptual and Motor Skills, 52, 785-786.

> In a study of 418 children in Grade 6 in Jamaica, the independent variables were sex, family size, birth order, occupational level, father's presence, preference for conceptual style, field dependence, reading achievement and mental ability. Mathematics achievement was the dependent variable. Stepwise regression analysis yielded mental ability, reading achievement and family size as the best predictors of achievement in mathematics.

SEATON, H.C. (1980) 217

The relationship of selected motivational variables to the 'A' level science achievement of Jamaican students. Unpublished M.A. Thesis, University of the West Indies, Jamaica.

> The study is based on data from 109 'A' Level science students in seven Jamaican high schools and 28 teachers. Findings suggested that success at 'A' level was more strongly influenced by intrinsic factors such as previous success (especially at 'O' level science), academic motivation and study habits and field independence than by extrinsic factors such as the influence of school, teacher, parent. At this level there was no significant difference between the sexes in performance in science.

3. ATTITUDE TO SCIENCE/MATHEMATICS

HAMILTON, M.A. (1978) 301

The scientific attitudes of high school students - A short study, Journal of Education in Science for Trinidad and Tobago, 5(3), 18-24.

> The Moore and Sutman Scientific Attitude Inventory (1970) was used to investigate these attitudes in a sample of 576 fifth form students from different types of schools situated in urban and rural locations. Boys were found to have decidedly more favourable attitudes on both dimensions of the scale - the intellectual and the emotional.

HAMILTON, M.A. (1980) 302

Attitude and achievement - Is there a link? Journal of Education in Science for Trinidad and Tobago, 7(3), 1-4.

> Scores on the Moore and Sutman (1970) Scientific Attitude Inventory administered to 576 fifth formers (248 boys and 328 girls) are examined for their relationship with performance in science subjects. The findings suggest that

there is a significant relationship between the two at 'O' level, and that this is more pronounced in girls.

HAMILTON, M.A. (1982) 303

Jamaican students' attitude to science as it relates to achievement in external examinations. Science Education, 66(2), 155-169.

Science Attitude was measured by the Moore and Sutman (1970) Science Attitude Inventory and performance at 'O' and 'A' levels of the G.C.E. examinations were the indices of achievement in the two-phase study. Of 248 boys and 328 girls in the original 'O' level sample (1975), 56 boys and 26 girls (more than half of those who did proceed to 'A' levels) were included in the later (1977) sample. Of the several findings drawn from the data, the author stresses the fact that although at 'O' level, there is, for both sexes a significant relationship between 'O' level science achievement and science attitude in the fifth form sample overall, for those students classified as high achievers, this relationship exists for the girls only, indicating that for the latter, attitudes may play a greater role in high level performance than for boys.

HAMILTON, M.A. (1983) 304

Preliminary work on the development of a Science Attitude Scale for Jamaican high school students, Caribbean Journal of Education, 10(1), 18-32.

The paper describes the statistical techniques employed in the derivation of the 36-item scale, reliability and validation exercises and proposals for futher refinement.

HAMILTON, M.A. (1985) 305

The attitudes of older Jamaican adolescents to "Women in Science". Unpublished paper. Mona, Jamaica: Faculty of Education, University of the West Indies.

A 35-item "Attitude to Women in Science" scale was developed along dimensions of sex roles, vocational concerns, personality/temperament, educational considerations and cognitive concerns. This was administered to a sample of 88 girls (58 from a single sex, 30 from a co-educational school) and 93 boys (60 from a single-sex, 33 from a co-educational school). Girls scored significantly higher on the scale than boys, the girls from single sex schools registering a more favourable attitude than the rest of the sample. Means for both sexes in the co-educational institution were almost identical. Schools had been matched for prestige, size, quality of staff, physical plant and range of academic offerings.

HAMILTON, M.A. (1986) 306

Scientific attritudes - some considerations for teachers. Science Education Research in Latin America and the Caribbean. Edited by P. Fraser-Abder. St. Augustine, Trinidad: Faculty of Education, University of the West Indies.

This paper reports salient findings pertaining to the scientific attitudes demonstrated by Jamaican high school students, distilled from five papers researched by the author. The two main findings are that: (a) overall, boys demonstrate more positive scientific attitudes than girls; however, girls categorised as high science achievers did register more favourable attitudes than their male counterparts. This was particularly true of females specialising in the sciences at university level. (b) having favourable scientific attitudes appears to impact more strongly on girls' performance in science subjects than is the case for boys. The conclusion drawn is that girls have to receive more encouragement than boys in order to counteract the general societal tendency which discourages interest in scientific endeavours. The implication of these findings for education in general and teachers specifically, are addressed.

STEPHENSON, L. AND MITCHELMORE, M. (1979) 307

The relationship between lecturer's teaching method and students' attitudes to mathematics in Jamaican teachers' colleges. Caribbean Journal of Education, 6(2), 159-173.

The attitudes to mathematics of 90 primary teacher trainees, taught by six tutors classified after observation as "investigative" or "authoritative" were measured. It was found that students of low and middle achievement indicated more enjoyment under investigative methods, whereas high achieving students enjoyed mathematics more under authoritarian methods. Students taught by the investigative methods generally regarded mathematics as a problem-solving process, while under the other method it was regarded as a set of rules.

4. COGNITIVE DEVELOPMENT AND CONCEPT ATTAINMENT

GLASGOW, J.L. (1985) 401

The role of out-of-school science popularization programmes as a support to secondary school science teaching. Paper presented at the Seminar-Workshop on problems of Science Popularization in the Caribbean, Port-of-Spain, Trinidad, October 8-11.

> Out-of-school science is seen as a means of providing children with a variety of experiences which can help to promote their interest in science and encourage meaningful cognitive activity. Some concepts which children are required to grasp at secondary level are pin-pointed and a few examples of existing sources of out-of-school science are examined for the contribution their programmes may make to an understanding of particular concepts.

ISAACS, P.A. (1976) 402

Some conservation concepts in Jamaican grade six students. Unpublished M.A. thesis, University of the West Indies, Jamaica.

> The study sought to determine the proportion of grade 6 students who had learned to conserve length, area, quantity, weight, internal volume, displaced volume and horizontality. The effect of intelligence, socio-economic status, type of school attended, location of school, and achievement in school on concept development were also investigated. The results showed that, except in the case of length, less than 50% of the sample of 586 ten to thirteen year olds had conserved these concepts. A video-taped test which could accommodate groups of up to 30, was one interesting feature of Isaacs' instrumentation.

ISAACS, P.A. (1981) 403

Preparation and validation of a videotaped test of conservation suitable for grade six students in Jamaica. Unpublished paper. Mona, Jamaica: School of Education, University of the West Indies.

> A thirty minute videotaped test was designed to standardise variables associated with the test's administration. The film presented situations involving conservation concepts such as liquid quantity, solid quantity, weight, displaced volume and horizontality. After trial, the test was administered to 586 urban and rural sixth graders and reliability and validity were examined by means of a test-retest procedure, factor analysis and comparison with clinical test results. Desired criteria were met.

MITCHELMORE, M.C. (1982) 404

Knowledge of basic geometrical concepts among Jamaican schoolchildren. Caribbean Journal of Education, 9(1), 14-31.

A survey was done to assess the level of knowledge of elementary geometrical concepts (primarily recognition of basic shapes and knowledge of their properties) among 185 Grade 5 students in upper and lower streams and 140 Grade 9 students in selective and non-selective schools in Kingston, Jamaica. The results indicate that the average Grade 5 child knows little geometry, but that students in selective schools have, on the whole, a satisfactory knowledge of elementary geometry in contrast to their counterparts in non-selective classes who are performing well below their potential. Increased emphasis on geometry teaching in primary schools is recommended. The author has also compared the performance of Jamaican students with that of German students at the same levels.

5. LEARNING AND SCIENCE EDUCATION

BINGHAM, E.W. and BINGHAM, K.C. (1972) 501

An experiment in the teaching of general science. Science Notes and News, (July), 28-29.

Discusses a first attempt to adapt the discovery approach in a first form general science class. The programme follows the lines suggested by Nuffield Combined Science.

STEWARD, J.W. (1979) 502

Understanding of non-technical words in science. Science Education Centre Newsletter, 10(1), 20-21.

The article indicates the participation of some Jamaican teacher training college and secondary schools in an international investigation on the understanding of non-technical words in chemistry, and presents some findings from the Jamaican sample.

6. METHODOLOGY FOR SCIENCE/MATHEMATICS EDUCATION

HENDRY, J.A. (1974) 601

UNESCO/UWI/UNICEF/Project/RLA/142 and the new technologies in education. Caribbean Journal of Education, 1(1), 52-57.

The article describes the steps taken to achieve one of the more significant objectives of the Project "to make appropriate applications of modern technology to teaching

and learning and to increase the capability of Teachers' Colleges, Teachers' Centres and the region as a whole for the production of educational materials".

HEWETT, V. (1980) 602

The teaching of the mole concept in Jamaican high schools. Caribbean Journal of Education, 7(2), 131-141.

The article examines the difficulties associated with the mole, and suggests ways of overcoming the teaching and learning of the concept at 'O' level. Difficulties identified include lack of understanding of proportions caused by conceptual immaturity of students, the highly abstract nature of the concept, inappropriate presentation of the material by teachers, and lack of enough background knowledge in students. Suggestions for overcoming the difficulties include careful building up of pre-requisite concepts over a period of time, and introduction of the concept through a series of phases along a concrete/abstract continuum.

ISAACS, I. (1980) 603

Teaching problem solving in sixth form college. Unpublished Paper. Mona, Jamaica: University of the West Indies.

The author plans an ongoing study to find out whether it is possible to improve the problem-solving abilities of mature high school students of average and above average mathematical ability by direct teaching, and if this can be done in a regular classroom following a prescribed syllabus. Work with two groups of pre-university level students (N = 21 and N = 26 respectively) has led Isaacs to advance tentative conclusions that (a) gains in routine problem-solving sessions did not carry over to test conditions, and (b) that in order to develop flexibility of approach in school mathematics, there is the need to start with inquiry type methods early, to foster development of the dualistic view of mathematics as a body of knowledge with algorithms for applying it, and processes for originating knowledge.

MITCHELMORE, M. (1977) 604

Experiments in individualized instruction at a Jamaican teachers' college, Caribbean Journal of Education, 4(1 & 2), 1-20.

The results from two experiments involving 414 students in a Jamaican teachers' college indicate that (a) students could learn geometry and statistics from individualised units, and (b) students seem to learn approximately the same about integers from an individualised unit as they do from traditional lectures. The practical problems of using individualised instruction, and the possible long term benefits to students are discussed.

NELSON, L. (1978) 605

Teaching of chemistry with special reference to organic chemistry at secondary school and university. Unpublished M.A. thesis, University of the West Indies, Jamaica.

The study analyses the perceptions of students and teachers at secondary and tertiary levels, of the aims and objectives of chemistry in their institutions. The 'O' and 'A' level syllabi are analysed in light of the comments from students and teachers; course units are designed to demonstrate how secondary and tertiary chemistry could be articulated.

SOUTH-GUY, E.M. (1981) 606

Educating student teachers to apply the Guilford Structure of Intellect model to induce active response learning in science classes in Jamaica. Unpublished Ed.D. dissertation, Columbia University Teachers' College, U.S.A.

The population for the study consisted of 144 high school students in Jamaica and 16 teacher trainees. After exposure to modular instruction, the 8 experimental trainees applying the Guilford SI categories were involved in 15-minute interaction sessions with high school students in classrooms. These trained applied the Serial-Centred Organisation of Content and the Probe Technique. The control group teachers employed the traditional lecture approach to instruction. A naive group of 8 students served as a second control group in the absence of a pre-test. Teacher probes and student responses for 48 instructional sessions were analysed. Significant change in teacher behaviour and subsequent student learning style were realised. These findings support the assumption that it is possible to change teacher behaviour through the application of a well-developed strategy, over a short period of time.

THOMPSON, A.J. (1982) 607

Programme for the improvement of the pre-service mathematics education of secondary teachers at the Teachers College in Jamaica. Unpublished Ed.D. dissertation, Columbia University Teachers' College, U.S.A.

In light of recent secondary school curriculum developments and what is currently taught at teachers' colleges, a set of criteria for the preparation of teachers of mathematics is proposed. On the basis of these criteria, guidelines are proposed and are used to analyse the present pre-service mathematics programmes. Found to be inadequate, a new programme is proposed and the means of its implementation is discussed. Includes recommendations for immediate and delayed action.

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7. PROVISIONS FOR THE TEACHING OF SCIENCE

GLASGOW, J.L. (1978) 701

Science in the Jamaican community: A survey of some aspects of the provisions for training in science. Unpublished M.A. thesis, University of the West Indies, Jamaica.

The provisions for training in science, opinion on their efficacy for employment, the factors which operate for the choice of science, and the opportunities for employment in science fields are investigated. The sample comprises 658 high school and 291 tertiary level students, as well as 67 persons in employment. The academic nature of science education in the formal institutions and its unsuitability for employment, as well the importance of interest as a facilitator for choice of science, are among the findings which emerge.

HAGGIS, S. (1983) 702

Science and technology education in Jamaican schools. Unpublished Draft Report. Paris: UNESCO.

The report, intended to supplement the wider UNESCO report on the development of secondary education in Jamaica, gives an overview of science and technology in schools. Some general issues and problems are discussed, and recommendations made for possible alleviation.

MITCHELMORE, J. (1984) 703

Science equipment in Jamaica: problems and directions. Unpublished paper presented at the Ministry of Education/UNESCO Workshop on the Production of Science Equipment, Kingston, Jamaica, February.

Based on data from a 1977 survey conducted by the Science Education Centre, U.W.I., Mona, the author identifies problems of the provision and utilisation of science equipment in Jamaica, and then suggests a framework for future direction of effort in this area.

STEWARD, J.W. (1978) 704

Science facilities and resources in Jamaican secondary schools. West Indian Science and Technology, 3,(1), 19-22.

The article focuses on laboratory facilities, laboratory assistance, science equipment, books and courses, based on data gathered from a 1977 survey organised by the Science Centre, U.W.I., Mona.

UNESCO (1983) 705

Development of secondary education - Jamaica. Paris: UNESCO.

The Report is a restricted document prepared for the Government of Jamaica. It reviews secondary education, including the inputs from primary and tertiary levels, identifies major issues, and makes recommendations for further improvement and development of secondary education. Within this review science education is, of course, addressed, and the need for substantially greater emphasis both quantitatively and qualitatively on work in science and mathematics. (See Haggis Paper 135)

8. SCIENTIFIC LITERACY

GLASGOW, J.L. (1981) 801

Scientific literacy in a selected sample of Jamaican grade nine students from new secondary and all age schools. Unpublished Ph.D. thesis, University of the West Indies, Jamaica.

Measures tapping four of the dimensions of scientific literacy outlined in the model of Showalter et al (1974) are devised, and used to quantify scientific literacy in the sample of 643 grade nine students. Performance on the measures are examined for interaction with several independent variables covering aspects of students' personal characteristics and home and school environments. Mental ability, motivation, reading ability, home science environment and urbanisation have significant impacts on student performance. School type makes no difference, and the effect of student sex is not marked.

GLASGOW, J.L. (1984) 802

Scientific literacy: Its meaning and its importance for Jamaica. Unpublished paper. Mona, Jamaica: Faculty of Education, University of the West Indies.

The paper explores the meaning of scientific literacy, and the implications of science for functional literacy are discussed. Those features in the Jamaican context which underline the need for increased scientific literacy in the populace are considered at the national level, and at the level of the educational system.

GLASGOW, J.L. (1986) 803

Science education and superstition. Torch, 29, 1-11. Kingston, Jamaica: Ministry of Education.

Level of superstitious belief is seen as one way of registering an individual's readiness to question all

things, one of the desirable attributes of scientific literacy. The responses of 643 grade nine students to a 20 item scale designed to quantify the level of superstitious beliefs is examined, and the implications for science teaching in schools discussed.

9. CURRICULUM DEVELOPMENT AND/OR EVALUATION

ALEXANDER, G. AND GLASGOW, J. (1981) 901

UNICEF Regional Primary School Project: Report on teacher training and curriculum development activities 1978-1980. Caribbean Journal of Education, 8(1), 75-101.

The main objectives of this project were to develop an approach to integration using existing curriculum content; to generate in teachers a positive attitude to the approach and to train them to use it; to provide support in the form of materials and encourage teachers to produce their own. Work was restricted to grades 3 and 4 in four rural and two urban schools, and addressed content in the areas of science, social studies and language arts. (A comment: The Project eventually produced some useful teacher-designed resource materials, and stimulated better work organisation, collaboration among teachers and use of local resources. Like so many projects, however, it was too short-lived for its potential gains to be realised; funding was available for only a further year beyond the time considered in this report).

CLARKE, E. (1979) 902

The preparation of high school students in mathematics for the world of work in Jamaica. M.A. dissertation, University of the West Indies, Jamaica.

The study investigates the type of mathematics required in the two major sectors of industry in the Jamaican society (commerce and technology), and the extent to which high school students are being prepared to meet these requirements. More mathematics is required in the sector of technology than in commerce. The mathematical competence of employees in commerce is seen to be more adequate for their work than that of employees in technology.

HAMILTON, M.A. (1976) 903

The development of an introductory ecology course for third year students in secondary schools in Jamaica. Science Education Newsletter, 7(3), 14-22.

A series of twelve units, based on the themes populations, environments, species and communities, interdependence of species, food cycles in nature, is designed, together with

details of materials and equipment needed (low cost, local emphasis), methodology (stressing student participation and practical work), and consolidation. Consideration is also given to arranging the course as a base for future study of ecology. An number of factors eg. teacher enthusiasm and extent of student pre-requisite knowledge, which might influence the success of the course was outlined.

NOTE: Full details of this course are given in the author's M.A. thesis of the same title (1973), from the University of the West Indies, Mona. This thesis also carries one of the earliest compilations from source documents of the history of the evolution of science education in Jamaica.

JAMAICA. MINISTRY OF EDUCATION. RESEARCH SECTION (1985) 904

World Bank III Pre Investment Curriculum Materials Project. Research Bulletin, (July).

The materials in social studies, mathematics, science and reading, developed for Grades 1-6, are put through a pre-testing research phase. Teachers were interviewed and classroom teaching/learning situations observed to inform revision.

JOHNSON, D.E. (1982) 905

The development of a diagnostic test in mathematics for third graders. Paper presented at a Research Conference, Ministry of Education, Jamaica, February 2-5.

The test was designed to determine specific weaknesses in mathematics among grade 3 students. The sample of 172 students was required to do a 30 item Diagnostic test covering various categories of mathematical concepts to identify mastery/non-mastery of categories. Analysis of wrong items allowed for identification of specific weaknesses, and patterns of error which might inform remedial work.

MITCHELMORE, M.C. (1980) 906

Three dimensional geometric drawing in three cultures. Educational studies in Mathematics, 11(2), 205-216.

Compares spatial and three dimensional drawing ability in the United States, England and Jamaica. Suggests that the observed differences reflect cross-cultural differences in attitude towards the use of spatial models in thinking, as partly revealed by the degree of geometrical emphasis in the schools' mathematics curriculum. Differences in degree of social conformity in the three countries contribute to the variation in sex differences.

NICHTER, R. (1968) 907

The curricular framework of general science program of junior secondary schools with recommendations for improvement - A report. (Nichter was Educational Advisor, San Diego State College Foundation Contract Team, USAID/Jamaica).

Science in the junior secondary schools is analysed in the light of five realities - (1) the national goals of junior secondary education (2) goals of the general instruction in the educational television series and that in the science syllabus (4) curricular practices in training colleges - comparison of the school syllabi with college syllabi, and time devoted to instruction. Weaknesses are identified and suggestions offered for improvement.

REAY, J.F. AND TURNER, A.D. (circa 1972) 908

The Pilot Project to Assist the Teaching of Science in Jamaica. Annual report, January 1971 - December 1971. Unpublished paper, Mona, Jamaica: The Science Centre, Faculties of Education and Science, University of the West Indies.

The report reviews the activities of the project in the areas of focus - curriculum development and advisory service. Details of the evaluation of the first year of use of the WISCIP and Mona Project materials in the lower secondary grades are presented. Overall results based on test performance of 2283 subjects from experimental and control groups suggest, among other things, that the Mona approach is better for non-selected pupils and is suitable for all.

10. NUTRITION EDUCATION

HAMILTON, M.A. (1983) 1001

Nutrition education, The role of the college of education. Nutrition Education: Role of Colleges of Education, pp.3-44. Paris: UNESCO. (Nutrition Education Series, 2). ED 82/WS/119.

Trends in the role of colleges of education in preparing nutrition educators are discussed in eight world regions - North America, Europe, Australasia, Africa, Arab States, Asia, South and Central America, but with special emphasis on the Caribbean. Data were obtained by a literature review for the first seven regions, but by means of a survey for the Caribbean. Conclusions include the recognition of a dearth of adequately trained nutrition educators world wide; that nutrition education appears to be more easily incorporated into formal programmes as a part of other courses; that more attention needs to be given to indigenous foods, to the science of nutrition and pedagogic principles to be used in passing this on; that there be

continuing support of international agencies in this field and co-operation among rich and poor countries; that colleges should expand their outreach services to provide in-service teacher training, as well as to function as centres for information and advice on nutrition aspects.

HAMILTON, M. (1983) 1002

A suggested outline for the introduction of nutrition education at the primary level in Jamaica. Primary School Curriculum Planning and Selected Case Studies, pp. 56-58. Paris, UNESCO. (Nutrition Education Series 4). ED.83/WS/41.

This material was presented at the International Conference on Nutrition Education, Oxford, England, 1977. It describes a method of incorporating nutrition education into the primary curriculum as a part of, and not in addition to, the existing curriculum. Specific content links are identified. The necessity for a practical approach, for the encouragement of positive attitudes to nutrition education, and for placing in the primary system the pre-requisites for work at the secondary level are emphasised.

HAMILTON, M.A. (1985) 1003

A survey of college-level nutrition education programmes in Jamaica. New Developments in Nutrition Education, pp. 118-127. Paris: UNESCO. Nutrition Education Series, 2).

In this paper the author explores in detail one of the findings of a 1980 survey as it pertains to Jamaica. This concerns real entry qualifications for college, poor levels of academic performance at college and less than desirable attitudes to nutrition education. Additional data were collected from college students and from college records (1979-1983). Nutrition Education was interpreted in the college context as Home Economics and Cookery. The study confirms the paucity of students who opt for Nutrition Education courses. The findings suggest that there was a general feeling that Nutrition Education is a "female" and low prestige subject, although some respondents thought men would make as good teachers and should be encouraged into the field. Attainment and entry qualifications tended to be better in single sex than at co-educational institutions.

HAMILTON, M.A., GORDON, W. and MURRAY,R.N. (1978) 1004

Project Report (on Jamaica). Three project reports on the testing of UNESCO Nutrition Education Curriculum Planning and Evaluation Guides, pp. 23-94. Paris: UNESCO. ED-78/WS/62.

The paper reports the findings of a joint UNESCO/School of Education Nutrition Education Project, encompassing the designing, implementation and evaluation of nutrition education curricula suitable for Grade 9 students in

secondary schools in Jamaica. Separate curricula for nutrition in the areas of general science, home economics and agriculture had been designed in the engagements curriculum design outlined in the UNESCO publication Nutrition Education Curricula (Griffin & Light, 1975). The main objective of the Project was to compare each of these new curricula with the appropriate section of the curricula in regular use in Jamaican schools, which had been designed by the Ministry of Education. As a spin-off it also served as an evaluation exercise for these latter curricula. The report details the background to, and design of the research, discusses findings and makes recommendations which largely bear on the need for teacher training.

KNIGHT, J. (1983) 1005

Teaching child health and development concepts to primary school children. Cajanus, 16(4), 205-213.

Lists examples of songs, jingles and skits developed by a research team at the Tropical Metabolism Research Unit of the University of the West Indies, to teach basic concepts of child development, health and nutrition, to primary school children in rural Jamaica. The aim of the project was to capture the children's interest and encourage them to share the experience with their families at home.

11. ENVIRONMENTAL EDUCATION

DUTTON, R. (1980) 1101

Environmental education: A suggested strategy for Jamaica, Caribbean Journal of Education, 7(1), 43-63.

The essential features of the proposal are for: (a) a council or secretariat to co-ordinate environmental activities; (b) the generation of a national "masterplan" with measurable objectives; (c) the institution of an Environmental Education Research and Teaching Unit as the main implementing agent for (b); (d) implementation of the "masterplan" involving teacher education, primary and secondary education, adult education and information and professional and vocational training.

EVANS, S. (1983) 1102

An analysis of Jamaican students' environmental knowledge, attitudes and activities at a sixth grade level in rural and urban communities. Unpublished M.A. thesis, University of the West Indies, Jamaica.

The study looks at the influence of attitudes, knowledge, involvement in environmentally related activites, demographic area and gender on the environmental awareness of a

sample of 228 grade six children from 6 urban and rural schools. There was a significant positive relationship between environmental knowledge and attitude scores, as well as between urbanisation and both knowledge and attitudes. Environmental activities and gender had little bearing on knowledge and attitude test scores. Environmental parameters used for test inclusion were pollution and health; natural resources and energy; population and ecology.

GLASGOW, J.L. (1979) 1103

Teaching with your environment in mind. Paper presented at the Annual Conference of the Association of Science Teachers of Jamaica.

The trans-disciplinary, activity-oriented, problem solving, student centred nature of the exercise is examined, as is the importance of localising the curriculum if the approach is to be successful. A model for interpolating the environmental approach into the school curriculum is presented.

GLASGOW, J.L. (1980) 1104

Strategies for the training of teachers in environmental education for primary and secondary schools and teacher education institutions. Working Paper prepared for the Sub-regional Training Workshop on Environmental Education in the Caribbean, Antigua, (June), pp. 9-20.

The paper proposes a scheme for pre- and in-service training of teachers in environmental education at all levels and suggests strategies for its implementation. A basic teacher training course in environmental education is also presented.

GLASGOW, J.L. (1981) 1105

The educational implications of using environmental resources. Paper presented at the Annual Conference of the Association of Science Teachers of Jamaica.

Concerns of scope, methodology and evaluation; of level and sequence in the educational system; of content and implementation are discussed.

GLASGOW, J.L., (ed.) (1983) 1106

Final report, Sub-Regional Workshop on Teacher Training in Environmental Education for the Caribbean. Mona, Jamaica: School of Education, University of the West Indies.

Seven working documents all from the UNESCO-UNEP teacher training series in environmental education were studies. For those in draft form, recommendations for amendments were

made. The exchange of information and experiences on the development of environmental education in the Caribbean was also one area of focus.

GLASGOW, J.L. (1985) 1107

Syllabuses with an environmental emphasis in the Caribbean. Paper presented at the Conference on Science and Technology Education for Future Human Needs, Bangalore, India, August.

The paper points to the increased emphasis on environmental concerns in the science syllabi of the Caribbean Examinations Council. It analyses three of these syllabi and indicates how syllabus requirements and evaluation procedures complement each other in the attempt to infuse an environmental dimension into science at the secondary level in the Caribbean.

GLASGOW, J.L. (1985) 1108

Preliminary directory of some environmental education activities in Jamaica. Unpublished paper. Mona, Jamaica: University of the West Indies.

Summarises information received from U.W.I. members in the faculties of Education and Natural Sciences, the Petroleum Corporation of Jamaica and the Office of Disaster Preparedness.

GLASGOW, J.L. AND ROBINSON, P. (1983) 1109

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The book outlines essential content for environmental education at this level, but more importantly deals with strategies for including this dimension into the curriculum, pedagogical approaches to, evaluation and management in the classroom of environmental education.

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The paper proposes criteria for the selection of environmental elements for the school curriculum; strategies for the preparation of materials with the involvement of teachers; for articulation across the various levels of the educational system and for the efficient use of existing personnel and infrastructure in the implementation process.

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