DOCUMENT RESUME

ED 313 246 SE 051 056

AUTHOR	Cohen, David; Fraser, Barry J.
TITLE	The Processes of Curriculum Development and Evaluation. A Retrospective Account of the Processes of the Australian Science Education Project.
INSTITUTION	Curriculum Development Centre, Canberra (Australia).
REPORT NO	ISBN-0642532-32-X
PUB DATE	87
NOTE	112p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*Curriculum Development; *Curriculum Evaluation; Curriculum Study Centers; Foreign Countries; Guidelines; *Science Curriculum; Science Education; Science Education History; Secondary Education; *Secondary School Science
IDENTIFIERS	*Australia; *Australian Science Education Project

ABSTRACT

This book provides a retrospective account of the processes of curriculum development and evaluation of the Australian Science Education Project (ASEP), a venture which pioneered large-scale State-Commonwealth cooperation in education in Australia. The processes are described to identify practices for future curriculum initiatives. Important implications are drawn for policy-makers and those interested in curriculum at the classroom, school, system, and national levels. Chapters include: (1) "Curriculum Responsibilities in Australia"; (2) "A History of the Development of ASEP"; (3) "Curriculum Processes and Products"; (4) "ASEP's Curriculum Development Processes: The 38 Steps"; (5) "Evaluation of ASEP Materials"; and (6) "Summary, Implications and Guidelines for Future Curriculum Activities." Extracts from five selected ASEP position documents are appended including the aims of ASEP, main ideas in ASEP materials, criteria for choosing topics for classroom study, stages of child development, and inquiry approach. Lists 44 references. (YP)

Curriculum Development Centre
Canberra
Australia

The Processes of Curriculum Development and Evaluation

A Retrospective Account of the Processes of the Australian Science Education Project

David Cohen and Barry J Fraser

THE PROCESSES OF CURRICULUM DEVELOPMENT AND EVALUATION

A Retrospective Account of the Processes of the Australian Science Education Project

DAVID COHEN
Associate Professor of Education
Macquarie University
New South Wales, 2109

BARRY J. FRASER
Professor, Head of School of Curriculum Studies
and Director of Science and Mathematics Education Centre
Curtin University of Technology
GPO Box U 1987 Perth 6001, Western Australia

This project was assisted by a small grant from the Curriculum Development Centre, Canberra.

Published in 1987 by
The Curriculum Development Centre
PO Box 34
Woden ACT 2606 Australia

CDC is a Division of the Commonwealth Schools Commission

International Standard Book Number
ISBN 0642532 32 X

26575-1-87

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

AUTHORS' FOREWORD

The project reported in this publication was conceived at a meeting of the Council of the Curriculum Development Centre (CDC) in 1976 The interest of the then Director (Professor Malcolm Skilbeck) and the CDC Council was in research into and the documentation of alternative approaches to the development, implementation and evaluation of curricula and curriculum materials The particular curriculum which was the focus of this study is the Australian Science Education Project (ASEP). which is educationally significant because it pioneered large-scale State-Commonwealth cooperation in education and was the first curriculum venture to involve the six diverse State systems of education

At that time, as at the present, there was growing interest in the devolution of control for curriculum decision-making, with several States and the Australian Capital Territory (ACT) opting for school-based curriculum decision-making (SBCD)

Meanwhile, CDC had accepted responsibilities for the dissemination of the curriculum **materials** produced by ASEP and had sponsored the Social Education Materials Project (SEMP) Concurrently, CDC was taking a leading role in supporting SBCD initiatives

ASEP, SEMP and SBCD represent three alternative sets of curriculum processes. ASEP was perceived as a "curriculum project", a centralised curriculum initiative with national funding and headquarters SEMP had been established with teams operating in each State, thus representing a partially decentralised project The introduction of SBCD meant that the locus of power and control for decisions about curriculum had been passed to the school and its community. As with so many educational issues, there were seen to be both some advantages and some disadvantages in locating decision-making power at each of the national, state and school levels.

This book involves a revisiting of the curriculum processes which were employed by ASEP and therefore is about one plan for producing high quality curriculum **materials** within a tightly controlled budget By providing this retrospective account of an important curriculum initiative, practical knowledge about the curriculum field is made readily available In particular, questions of the efficiency and effectiveness of ASEP processes and materials are explored The book reflects upon some of the hopes and the realities of the large ASEP community. It contains many important lessons for those interested in curriculum at all levels (classroom, school, systemic and national) and provides valuable advice for both policy-makers and practitioners.

DAVID COHEN and BARRY FRASER

FOREWORD BY JANE BUTLER KAHLE

The book which you are about to read details the strengths and weaknesses of a particular curriculum effort, the Australian Science Education Project (ASEP) In addition, it delineates a general approach for curriculum development which is both realistic and pragmatic because the authors (both curriculum experts) have described the promises and pitfalls which can befall any large curriculum project.

In its description of the Australian Science Education Project, the book places that project in its historical context, stating that:

> *The establishment of ASEP as Australia's first nationally-supported curriculum activity was an exciting event at an exciting time of Australia's curriculum history. Politically, it was important that ASEP could accommodate both the centralists and those who supported the school-based curriculum movement which had taken root in some pockets and States. (Chapter 1)*

In the late 1960s and early 1970s when ASEP was conceived and lauched, Australians had the advantage of hindsight concerning what went either right or wrong with earlier large-scale projects in the U.K. and the U.S. as well as the advantage of foresight concerning the needs which were not met by other national science curriculum efforts. For example, U.S. projects such as Biological Sciences Curriculum Study (BSCS), Chemical Study (Chem Study) and Physical Science Study Course (PSSC) all were oriented towards educating future scientists and engineers Each produced rigorous textbooks and ancillary materials with high reading levels and with abstract conceptual orientations suitable for fully formal thinkers. However, each project used a team approach for curriculm development and each was committed to "hands-on" activities as well as the inclusion of process skills ASEP incorporated the latter three aspects, which were strengths, while avoiding the restrictive and elitist nature of the curriculum materials themselves. That is, ASEP was committed to developing science curriculum materials suitable for all children, written at the appropriate cognitive level and readable at the appropriate grade level. Indeed, its Guidelines Conference reported two orientations: (1) to treat science as an integrated study, and (2) to follow an enquiry approach and develop competency in scientific enquiry (Chapter 4).

Although the book is valuable for its analysis of the reasons for the successes and failures of ASEP, it contributes most by its detailed synthesis and description of the curriculum process. For example, how is a national team put together, what enables some writing teams to work together effectively, why is formative evaluation valuable and how does one incorporate the results of field trials into the final product? These and many more questions are answered by the authors. Overall the book provides the reader with both a theoretical context and a pragmatic model for curriculum development.

Today, when many countries are seeking ways to educate both a scientifically literate public and a technologically able work force, Cohen and Fraser have provided the insights needed for effective, efficient curriculum work in science

JANE BUTLER KAHLE
Dean of Education, University of Northern Colorado
Chairperson, Biological Science Curriculum Study

ACKNOWLEDGEMENTS

The development of this publication has spanned a period of nearly 15 years since the first conception of the idea to document the **processes** of the Australian Science Education Project (ASEP). Throughout this period, there has been the steadfast and ever-reliable typing support of Mrs Claire Weller in the School of Education office at Macquarie University. At Curtin University of Technology, Barbara Batty provided the skilful and careful wordprocessing needed to prepare this manuscript for typesetting, which was performed very capably by Roberta Sumption under Eddie Lee's direction. There also has been a number of other notable contributions, several of which are acknowledged below.

The staff of the Australian Science Education Project provided questionnaire responses during the life of the project. Many ASEP staff have since provided helpful additional information through interviews, comments on the manuscript and in many other constructive ways. We would like especially to thank the following ASEP staff who assisted in several ways:

Dr Les Dale (formerly Director of JSSP and Assistant Director of ASEP)
Mr John Edwards (James Cook University of North Queensland)
Dr Darrell Fisher (Tasmania)
Mr H.O. Howard (formerly Director of ASEP)
Mr Laurie Howell (Western Australia)
Dr W ("Jackie") Lang (Victoria)
Mr Ron Page (South Australia)
Dr Greg Ramsey (formerly Assistant Director of ASEP)
Mr S. Ron Shepherd (Victoria)

A group of four students undertaking a Bachelor of Arts (Honours) program in Curriculum Studies at Macquarie University in 1971 undertook an important role in the early part of this research. With the generous support of the former ASEP Director and staff, and under the guidance of the senior author of this publication, this group spent a busy week in Melbourne visiting the delightful ASEP headquarters at "Glenbervie" in Toorak. Thorough investigative procedures were employed, including interviews (some tape recorded), file searches and the administration of questionnaires. The students involved were:

Brother Peter Butcher
Graeme Butz
Michael Gallagher
Sally Liddy

Research assistance was provided at different times by Mrs Judy Lee, Ms Kaye Raymond and Mr Brian Jarman.

Finally, we acknowledge the support of Professor Malcolm Skilbeck and the Curriculum Development Centre for providing sponsorship and minor financial ...rt to assist with provision of typing facilities.

CHAPTER 1

CURRICULUM RESPONSIBILITIES IN AUSTRALIA

This introductory chapter is one of several which provide some background context for the present study of ASEP's curriculum development and evaluation processes. In particular, this chapter describes how the differing amounts of centralised curriculum control and school-based curriculum decision-making in the various Australian States gave rise to a decision that ASEP materials would be flexible and permit adoption, rejection or adaptation in each State

CENTRALISATION AS BASIS OF CURRICULUM CHANGE IN AUSTRALIA

Upon Federation in 1901, the Australian Constitution reserved for the States those powers not specifically delegated to the Commonwealth One of those powers was education. For a variety of reasons (including historical, economic, geographic and educational philosophy reasons), responsibility to provide free and universal education for all children of school age remained with the State Governments Earlier, each colony had established a centralised Education Department, responsible through the Minister for Education to parliament for government schools in the State. It was believed that this form of educational administration would assist in providing equality of opportunity and access to education for all Australian children and in ensuring that local needs were better met.

The expansion of enrolments in government schools (c.f., Table 1) was parallelled by a growth in the central administration in each State and Territory needed to provide for the schools.

TABLE 1: Enrolments in Australian Government Schools (Primary and Secondary), 1910-1980

Year	Enrolment
1911	584,000
1912	735,000
1930	922,000
1940	864,000
1950	973,000
1960	1,612,000
1970	2,081,000
1980	2,318,000

The centralised Education Departments were intended to provide uniformly good buildings and teachers, to develop curricula and to ensure that these curricula were implemented effectively throughout the State. At the same time, public pressures existed which demanded evidence that "standards were being maintained" Historically, inspectorial systems and external examinations were system responses to providing such evidence

The expansion of enrolments and of educational provisions resulted in unwieldiness and stresses within the centralised systems These had implications for the development, implementation and evaluation of curricula. Also, a number of other changes were emerging which had curriculum implications These included:

- longer and better quality teacher education programs, with consequent greater recognition of the professional qualities of teachers;
- expression by teachers of increased desire to be involved in some aspects of curriculum decision-making,
- research findings which consistently indicated that greater teacher involvement in decision-making led to greater commitment to implementing the decisions made,
- improved opportunities for postgraduate studies in education, leading to a richer reservoir of qualified tertiary educators and leaders for the curriculum fields;
- increased expectations for teachers to provide more motivating learning experiences coupled with growing complexities of classroom management of students subjected to the television age;
- the development of evaluation procedures and instruments which probed beyond memorisation objectives

Concurrently, public reactions against the costs of "big government" and growing employment in "the public service" had led politicians both at Commonwealth and State levels to place ceilings on staffs in government departments These and other changes generated a changing milieu on the Australian educational scene of the quarter-century from 1955 to 1980

DECENTRALISATION AND DEVOLUTION OF CURRICULUM

One response in some States was (perhaps euphemistically) referred to as "decentralisation" This involved the dispersal of some of the administrative arrangements to newly established "regional offices" Decentralisation occurred notably in Queensland, New South Wales (NSW) and Victoria. In NSW, the first (and then only) region had been established at the instigation of people in Riverina in 1948. A series of recommendations from NSW Government and Education

Department Committees subsequently led to the gradual establishment from 1951 to 1969 of 10 additional regions.

From 1969 to 1982, there were five metropolitan and six country regions in NSW. In 1982, the number of metropolitan regions was reduced to four According to the official NSW Handbook.

The basic purpose of decentralization is summarised as:

(i) to enable the administrative work of the Department to be carried out with greater efficiency and more expeditiously;

(ii) to facilitate the adaptation of the details of administration more closely to the special features and needs of the differing regions of the State;

(iii) to build up an active local interest in educational services. (NSW Department of Education, 1985, p 100)

Thus, decentralisation was perceived in NSW largely as a strategy for distributing administrative responsibilities, with relatively minor responsibilities being passed to regions for curriculum decision-making as a consequence of the 1976 so-called "three-tier" policy.

In Victoria, three regional directorates (located in Ballarat, Bendigo and Gippsland) were established at the start of 1972 The powers of the Regional Directors included limited financial authority, contracting for fuel, minor site works, bus services, transfer of staffing within the region and the provision of some services including the "coordination of courses and curriculum within the region"

Various forms of administrative reallocations associated with decentralisation had a limited impact upon changing the patterns of curriculum decision-making in Australia. For both primary and secondary schools, such powers in most States remained basically centralised. By contrast to decentralisation, **devolution** involves the transfer of power from a centralised educational authority to regional offices or schools. Thus, devolution allows educationally significant decisions (including major curriculum policies) to be made away from the central office Some effects of devolution are thus to reduce the power of the centralised authority and to increase opportunities for participation, for sharing of decision-making concerning policies and for generating curriculum diversity and choice. It is argued that, because decisions are made closer to the students, devolution will lead to curricula becoming more relevant to particular classroom situations.

Critics of devolution have argued that inequalities in educational opportunity will result when devolution is effected because of disparities in community expectations and in the local availability of human and physical resources Some critics also argue that insulation from central control makes decisions more amenable to political interference and manipulation. Then, too, the political realities in Australian States demand that each Minister of Education accept ultimate responsibility for what happens in schools. In answer to a question in parliament, any Minister who responded that "it's up to the individual school/principal/teacher" rather than "my

officers have advised me that in accordance with Departmental policy the position is that this school is spending **x** hours per week in the teaching of mathematics" surely would be risking political suicide! The balance is indeed a delicate one as one treads the tightrope between professional trust and devolved decision-making, on the one hand, and ministerial responsibility with consequent checks and balances on the other hand.

In the 1970s, there were trends in curriculum decision-making towards curriculum autonomy in all Australian States and Territories. More power was being handed from the centralised State Departments of Education to regions and to schools, and freedom evolved for curriculum "consumers" (teachers, parents and **even** students!) to share responsibility for curriculum development. Official statements from the various Departments conveying curriculum autonomy have been documented elsewhere (see, for example, Cohen, 1972). Although the pendulum of devolution has swung to-and-fro in several Australian States during the past 10 to 15 years, the situation has differed substantially from State to State and, indeed, often even from year to year within particular States. Such vacillations have occurred, for example, even as a response when the incumbent as Director-General of Education within a State has changed. For the purposes of reviewing the initiation of a major **national** curriculum project, it is important to be aware of this almost turbulent set of contexts around the States of Australia during the late 1960s and early 1970s. It was into such contexts that the Australian Science Education Project (ASEP) was to be launched.

IMPLICATIONS OF CURRICULUM ORGANISATION FOR ASEP

It was in 1968, early in this period of curriculum fermentation, that the decision was made to provide funding for the Australian Science Education Project (ASEP). In several States, there was an acceleration and escalation of support for curriculum autonomy and school-based initiatives. So, it could be anticipated that there would have been a negative reaction to ASEP if its materials were perceived in any sense either as imposing constraints upon school-based decision making or as usurping the curriculum prerogatives of the States.

Hence, from the outset, ASEP had to be seen as involving flexible and modular materials which were available for selection, or rejection, and adaptable to the variety of curriculum patterns between and within Australia's States and Territories.

This foregoing climate gave rise to the formulation by the curriculum representatives of the participating States of three principles upon which the work of ASEP was to be based. These were:

(1) *The Project must produce a range of instructional materials sufficient in quantity to satisfy a major portion of the requirements for courses in secondary school science from Grades 7 to 10.*

(2) *The Project must take account of the similarities and differences in the present and projected pattern of science education in all States from Grades 7 to 10.*

Department Committees subsequently led to the gradual establishment from 1951 to 1969 of 10 additional regions

From 1969 to 1982, there were five metropolitan and six country regions in NSW In 1982, the number of metropolitan regions was reduced to four According to the official NSW Handbook.

The basic purpose of decentralization is summarised as:

(i) to enable the administrative work of the Department to be carried out with greater efficiency and more expeditiously;

(ii) to facilitate the adaptation of the details of administration more closely to the special features and needs of the differing regions of the State;

(iii) to build up an active local interest in educational services (NSW Department of Education, 1985, p 100)

Thus, decentralisation was perceived in NSW largely as a strategy for distributing administrative responsibilities, with relatively minor responsibilities being passed to regions for curriculum decision-making as a consequence of the 1976 so-called "three-tier" policy.

In Victoria, three regional directorates (located in Ballarat, Bendigo and Gippsland) were established at the start of 1972 The powers of the Regional Directors included limited financial authority, contracting for fuel, minor site works, bus services, transfer of staffing within the region and the provision of some services including the "coordination of courses and curriculum within the region".

Various forms of administrative reallocations associated with decentralisation had a limited impact upon changing the patterns of curriculum decision-making in Australia For both primary and secondary schools, such powers in most States remained basically centralised By contrast to decentralisation, **devolution** involves the transfer of power from a centralised educational authority to regional offices or schools. Thus, devolution allows educationally significant decisions (including major curriculum policies) to be made away from the central office. Some effects of devolution are thus to reduce the power of the centralised authority and to increase opportunities for participation, for sharing of decision-making concerning policies and for generating curriculum diversity and choice It is argued that, because decisions are made closer to the students, devolution will lead to curricula becoming more relevant to particular classroom situations

Critics of devolution have argued that inequalities in educational opportunity will result when devolution is effected because of disparities in community expectations and in the local availability of human and physical resources Some critics also argue that insulation from central control makes decisions more amenable to political interference and manipulation. Then, too, the political realities in Australian States demand that each Minister of Education accept ultimate responsibility for what happens in schools. In answer to a question in parliament, any Minister who responded that "it's up to the individual school/principal/teacher" rather than "my

officers have advised me that in accordance with Departmental policy the position is that this school is spending **x** hours per week in the teaching of mathematics" surely would be risking political suicide! The balance is indeed a delicate one as one treads the tightrope between professional trust and devolved decision-making, on the one hand, and ministerial responsibility with consequent checks and balances on the other hand

In the 1970s, there were trends in curriculum decision-making towards curriculum autonomy in all Australian States and Territories More power was being handed from the centralised State Departments of Education to regions and to schools, and freedom evolved for curriculum "consumers" (teachers, parents and **even** students!) to share responsibility for curriculum development Official statements from the various Departments conveying curriculum autonomy have been documented elsewhere (see, for example, Cohen, 1972) Although the pendulum of devolution has swung to-and-fro in several Australian States during the past 10 to 15 years, the situation has differed substantially from State to State and, indeed, often even from year to year within particular States Such vacillations have occurred, for example, even as a response when the incumbent as Director-General of Education within a State has changed. For the purposes of reviewing the initiation of a major **national** curriculum project, it is important to be aware of this almost turbulent set of contexts around the States of Australia during the late 1960s and early 1970s It was into such contexts that the Australian Science Education Project (ASEP) was to be launched.

IMPLICATIONS OF CURRICULUM ORGANISATION FOR ASEP

It was in 1968, early in this period of curriculum fermentation, that the decision was made to provide funding for the Australian Science Education Project (ASEP). In several States, there was an acceleration and escalation of support for curriculum autonomy and school-based initiatives. So, it could be anticipated that there would have been a negative reaction to ASEP if its materials were perceived in any sense either as imposing constraints upon school-based decision-making or as usurping the curriculum prerogatives of the States.

Hence, from the outset, ASEP had to be seen as involving flexible and modular materials which were available for selection, or rejection, and adaptable to the variety of curriculum patterns between and within Australia's States and Territories.

This foregoing climate gave rise to the formulation by the curriculum representatives of the participating States of three principles upon which the work of ASEP was to be based These were:

(1) *The Project must produce a range of instructional materials sufficient in quantity to satisfy a major portion of the requirements for courses in secondary school science from Grades 7 to 10.*

(2) *The Project must take account of the similarities and differences in the present and projected pattern of science education in all States from Grades 7 to 10.*

(3) None of the States will prescribe the materials for use in schools, or guarantee their use, in the belief that the use of the materials must arise from their quality. Each school should be free to choose what it considers to be the most suitable course, topic, method and approach to science (ASEP Information Brochure 1)

CONCLUSION

The establishment of ASEP as Australia's first nationally-supported curriculum activity was an exciting event at an exciting time of Australia's curriculum history. Politically, it was important that ASEP could accommodate both the centralists and those who supported the school-based curriculum movement which had taken root in some pockets and States. The widespread educational acceptance of the Project rested on satisfying a similarly wide spectrum of educational views.

This chapter is one of three providing background information pertinent to the present study of ASEP's curriculum processes. Whereas Chapter 3 considers the important distinction between curriculum processes and products, the next chapter (Chapter 2) provides a review and examination of stages in the history and development of ASEP.

CHAPTER 2

A HISTORY OF THE DEVELOPMENT OF ASEP

Between the acting of a dreadful thing
And the first notion, all the interim is
Like a phantasma or a hideous dream (Julius Caesar, 1.2)

The evolution of ASEP as the first national curriculum materials development project in Australia was fundamentally the product of serendipity - the coalescence of a fortuitous set of people, ideas and political circumstances, coupled with the pressures of educational needs, money, politics and time This is not to suggest that the actual development of the Australian Science Education Project was either unplanned or accidental In fact, ASEP's former Assistant Director, Dr Les Dale, described it in this way

It was a deliberately planned interaction, taking full advantage of favourable conditions, a project for which a group of people worked carefully, deliberately, and over a long period to influence politicians, obtain interim funding and demonstrate the viability of the scheme (Dale, personal communication, 1972)

The documentation of how the Project was conceptualised, by whom and for what purposes is the major concern of this second chapter. "The time was ripe , wrote Dale (1972), "for the establishment of a project like ASEP". Perhaps that ripeness was fortuitous Perhaps it was nurtured by the cumulative efforts of persons who struggled to break new ground. In either case, the evolution of the Australian Science Education Project was the outcome of a unique and peculiar set of contributions of individual persons

The purpose of this second background chapter is to provide a historical perspective on some key events prior to or in the early days of ASEP's existence. Discussion covers ASEP's precursor, the Junior Secondary Science Project

This chapter and others draw upon a report developed during a visit to ASEP Headquarters with one of the authors (David Cohen) by several students enrolled in a BA(Honours) program in curriculum studies at Macquarie University in 1971 This group made an exhaustive exploration of ASEP files, interviewed most ASEP staff members, administered a questionnaire and developed a draft report which was reacted to by ASEP's Director and Assistant Director This book also draws upon (1) a consultants' report on evaluation procedures prepared in 1981 by Neil Baumgart, David Cohen and Michael Dunkin, (2) questionnaires answered by some former ASEP staff at a conference on ASEP convened by the Curriculum Development Centre in 1977 and (3) retrospective audiotaped interviews with former ASEP staff, especially Les Dale and Greg Ramsey (Assistant Directors), Laurie Howell and Ron Shepherd (Area Specialists) and Sue Jarman and Darrell Fisher (Materials Development Officers).

(JSSP), the initial proposal for the establishment of ASEP and a "guidelines" conference which served to lay some of the philosophical foundations on which the Project was built.

THE JUNIOR SECONDARY SCIENCE PROJECT AS PRECURSOR TO ASEP

An early phase predating the evolution of ASEP was the dissatisfaction felt by the Science Standing Committee of the Victorian Universities and Schools Examinations Board (VUSEB), school administrators, teachers and scientists with the "Course of Study in Science" for junior secondary school children in the State of Victoria This dissatisfaction provoked discussion among interested persons. Some of the dialogue was reported in **Labtalk,** the journal of the Science Teachers Association of Victoria. The need was expressed for "a thorough revision of the course" (Wilkinson, 27 September 1967, in a letter to the then Commonwealth Minister of Education and Science, Senator J. G Gorton).

The Science Standing Committee of VUSEB conducted a two-day conference in October 1963 to discuss revising the science syllabus. The Standing Committee invited representatives of the Catholic Science Teachers Association, the Science Teachers Association of Victoria, the Secondary Teachers College, the University of Melbourne and "interested persons from the CSIRO, from business and from industry" (Wilkinson, 1967) This led to the establishment of a Steering Committee, whose main recommendations were:

(1) A course in general science, suitable for all pupils Grades 7-10, should be drawn up

(2) The aims of such a course should be clearly set out prior to its formulation

(3) That scientists in the several areas of study - roughly astronomy, geology, physics, chemistry and biology - should set down what was considered to be science in those areas in the mid-twentieth century.

(4) The findings of child psychology, educational theory, testing and assessment should be incorporated into the formulation of the course

(5) The matter of individual differences in pupils should be taken into account.

(6) A Syllabus Committee, drawn from experienced practising teachers at the levels considered, should draw up an overall syllabus for Grades 7-10 and a detailed syllabus for Grades 7 and 8. (Wilkinson, 1967, letter to Gorton)

A syllabus Committee was soon established. It comprised a group of 16 teachers and members of the Science Standing Committee, financed by the Myer Foundation. In one full week during January 1964, this Syllabus Committee

produced the outlines of a syllabus for Grades 7-10 and a fairly detailed syllabus for Grades 7 and 8.

Wilkinson described the involvement of scientists:

Next, scientists, mainly from Melbourne and Monash Universities set down just what they considered to be the elements of various branches of science in this mid-twentieth century - not only subject matter, but general outlook, required skills, attitudes. (Wilkinson, 1967, letter to Gorton)

These statements were passed on to the Science Standing Committee and, in turn, to the Syllabus Committee.

The syllabus was based on the statement of aims of the Standing Committee, on the science enumerated by scientists and on the educational ideas that had been prepared by teachers and other educationists

The Science Standing Committee considered that written materials of some form, although not necessarily textbooks, were desirable to cater for the wide range of abilities in a science class. Wilkinson (1967, letter to Gorton) stated that "some form of individualised instruction was probably essential" Wilkinson (who was then Deputy Chairman of the Victorian Universities and Schools Examinations Board Science Standing Committee) initiated discussions with Dr William C Radford (then Director of the Australian Council for Educational Research, ACER) with a view to establishing a joint project between VUSEB and ACER. The reaction from ACER was favourable. Members of a project group were appointed by the Science Standing Committee to commence work in January 1966. The Education Department of Victoria seconded one teacher on a full-time basis and another on a half-time basis. The Catholic Office of Education was not able at that stage to provide a teacher on secondment Participation by independent school teachers was financed through a number of trusts and foundations, together with donations from industry. Thus originated what became known as the Junior Secondary Science Project (JSSP). The charter of the JSSP included:

(1) developing assignments for pupil use;

(2) devising suitable experiments and recommending equipment, apparatus and materials for such experiments and activities;

(3) arranging trials of materials in schools,

(4) evaluating the results of these trials, and where necessary

(5) rewriting and redeveloping materials and arranging further trials and evaluating, so that finally

(6) tested materials could be prepared for subsequent publication (M L Turner, 1968, Proposal for Extension of the JSSP)

JSSP materials were intended to develop the following objectives in pupils.

(1) an understanding of the universe as conceived by scientists,

(2) some understanding of the scope and nature of science,

(3) certain skills important to science,

(4) certain attitudes relevant to science. (VUSEB, 1967, Aims of JSSP)

These objectives were stated in more specific terms. The JSSP accepted the principles that the preparation of learning materials should take account of

(1) the need for all children to have some common experiences and achieve certain common objectives;

(2) the need to provide for differences in pupils of prior experience and in various abilities and aptitudes both within and across units, and

*(3) the need to engage pupils actively in the instructional-learning process and ways, for illustration, of observing, performing experiments, recording results, drawing conclusions and making interpretations. (Turner, 1968, Proposal for Extension of the JSSP)**

The JSSP also decided that the learning materials should be subjected to classroom trials and evaluated by both project staff and practising classroom science teachers (M. L. Turner, 1968). By 1967, the JSSP had developed considerable materials but was experiencing the constraint of limited funding and facilities to develop materials of the range and standard felt desirable

Following the opening by him of the Science Equipment Exhibition at the Exhibition Buildings in Melbourne in 1967, the then-Senator J. G Gorton, Commonwealth Minister for Education and Science, was approached informally by Wilkinson (in the presence of Cohen) concerning the willingness of the Commonwealth Government to provide assist nce to the JSSP The Minister in reply informally stated that he considered that such a request would receive favourable support provided that two or more States made a joint approach

Meanwhile, the Directors-General of Education in the States of Tasmania and South Australia had expressed an interest in the JSSP. The Director of ACER wrote to the Directors-General of the Departments of Education of Victoria, Tasmania and South Australia (July 24, 1967) "asking if they would approve a joint approach to the Commonwealth Government, asking it to support the continued development

* Dr Mervyn L. Turner recently had completed postgraduate studies at Stanford University in [illegible] of science education and returned as Assistant-to-the-Director of ACER

and more extensive trial of the JSSP" (Wilkinson, 1967) All three States replied and accepted the idea of a meeting to prepare a joint approach:

The degree of enthusiasm for the current materials and the suggestions made about where they can most effectively be used differ from state to state, but all three have agreed that they would participate in improving the materials, and in using them. (Wilkinson, 1956, letter to Gorton)

A letter was then written to Senator J G. Gorton outlining a number of reasons for seeking Commonwealth interest and assistance in the extension in scope of the JSSP materials and for their use in Victoria, South Australia and Tasmania The need for coordination of efforts in the preparation of educational materials in the various States of Australia was emphasised Difficulties were expressed concerning the inadequacies of staffing, finance and facilities available to JSSP It was advocated that enrichment materials should be developed and that JSSP "could be expanded as a major educational development in Australia" JSSP basically had comprised a set of aims and content areas based on the perceived needs of junior secondary school students in the State of Victoria Written on behalf of VUSEB, ACER and the Directors-General of Education of three States, the proposal sought support for the extension of the JSSP.

By the end of 1967, the JSSP had developed nine units of learning materials for Year 7 Science. These materials had undergone two trials in schools, had been revised subsequently and were to be produced commercially by the Australian publishers, F W Cheshire Pty Ltd of Melbourne In addition, nine units of science learning materials were being developed for Year 8 Of these, four had undergone trial but none had been revised for second trial. JSSP had stated that it would be unable to prepare materials for Years 9 and 10 unless further funding became available.

THE ASEP PROPOSAL

Following the conference in Melbourne in November 1967 of representatives of ACER, VUSEB and Departments of Education from Victoria, South Australia, NSW and Tasmania, a proposal was prepared early in 1968 by ACER (written by Dr M L Turner) seeking support for an expanded JSSP for $1.3 million for the period 1968-1972. This was the only official approach to the Commonwealth Government. The major purpose of the proposal was for the development of instructional materials in science, for use by pupils and teachers in the junior secondary levels (Grades 7-10) in schools of South Australia, Tasmania and Victoria. The proposal argued that

While nine units appear to represent a reasonable provision as the number of units which could be profitably used at Victorian Grade 7 level, the JSSP has not had the resources to extend each unit to cater for school, class, and pupil differences - for example, by way of well-worked out "research" and other enrichment activities, a series of audio-visual aids, or a series of small authoritative and interesting reference booklets for pupils As many man-hours of development work would be necessary for these additional materials as has been given to the minimum provision in the existing nine units

The proposal stipulated that the existing JSSP project should not prejudice possible future expansions of the project. It was stated that the three supporting States desired materials that:

could be used by schools to satisfy all or a major part of their requirements for such (science) materials .. up to and including Grade 10.

The principle was also expressed that with

adequate support such a project could develop learning materials for pupils, manuals for teacher use, and complementary materials, equipment and aids which would attract teachers to use them by their quality and demonstrated effectiveness.

This principle was clarified (c f , Howard, interview, 1972) to mean that there would be no **prescription** of the project materials for use in schools This implied also no **guarantee** of their use, but rather adoption on the basis of their intrinsic quality.

The proposal recommended that there should be

(a) a basic provision, equivalent to what could reasonably be attempted in approximately 600 class periods of 40 minutes each, and

(b) additional provision of about 300 such periods

On that basis, it would be necessary to strengthen and expand considerably the JSSP staff. Further, it was considered necessary:

to promote skills and competencies in pupils through a sequential learning process in which they could master concepts of considerable depth and complexity.

To achieve this objective "through effective schemes for integrating the separate units", competent writers would be required, with adequate time at their disposal.

They will need highly competent direction from within the project, and consultants expert in science and/or education must be available to them.

It was estimated in the Proposal that an expanded project would need to produce or redevelop "almost ten times as much effective learning materials in three years as the existing project has produced in two years with a staff equivalent to about four full-time workers"

It was proposed that a professional staff for the expanded project should be approximately 25 full-time equivalents. The following project staffing structure was suggested in 1968

Director	(1)
Assistant Director Development	(1)
Area Specialists in biology, physics, chemistry, and astronomy and geology	(4)
Writers	(12)
Assistant Director Services	(1)
Research and evaluation specialists	(1)
Teacher Liaison Officer	(1)
Test constructors	(2)

Further detailed proposals were submitted concerning other positions for both professional and support staff and how they should be filled This included suggestions for external consultants and test item writers.

A restricted (four-year) timetable was supported by representatives of the three States. This included proposals for unit development, trials, revision and publication. Three alternatives were presented:

(1) A substantially reduced project, financed by royalties, could maintain regular revision and further supplementation of JSSP materials; or

(2) a new and different approach to junior secondary science education could be applied by another project or a reorganised JSSP; or

(3) the project's staff and organisation could be regarded as the means of initiating a National Curriculum Centre (or Institute) to undertake curriculum development in science, or, more widely, in the many school subjects.

It is fascinating to reflect in retrospect on the third proposal as foreshadowing the possibility that the project could become the precursor for national curriculum initiatives. Maybe the suggestion was a form of political enticement, but it could have been a genuine belief in the desirability and practicability of national curriculum projects.

The estimated cost of the project was $1 3 million. This was based upon the project running at full strength for three years, with an initial recruitment stage during

the latter part of 1968 and a "run-down" period of six months after 1972. The estimated annual co-ʼ were as follows·

1 Director	10,000
2 Assistant Directors	18,000
7 area specialists	56,000
11 writers	60,000
6 writers	30,000
25 clerks/etc.	50,000
superannuation & payroll tax	20,000
accommodation	60,000
hardware	30,000
software	30,000
consultants	10,000
	$374,000

The total costs were estimated to be·

3 years at $374,000	1,122,000
"Tailing off" costs	178,000
	$1,300,000

The proposal was for the project to remain under the administration of the ACER, with a coordinating Council including representatives of ACER, Directors-General of Education, representatives of curriculum authorities, science teachers and scientists A separate accounting organisation and a personnel structure were to be established. The Director of the project was to be responsible immediately to the Director of the ACER or his deputy.

In some ways, the 1968 proposal to the Commonwealth Government was a detailed document Its specifi- tions were determined according to the experiences of the existing JSSP, as there was no other precedent within Australia to act as a model It imposed constraints with regard to time, finance, managerial structure and the number and qualifications of project personnel.

A meeting was convened in November 1968 to consider the ACER proposal. In attendance were:

H K Coughlan (Meeting Chairman) and K L Jennings (Commonwealth Department of Education & Science)
R. A. Reed (Victorian Education Department)
A O McPherson (South Australian Education Department)
J. G. Scott (Tasmanian Education Department)
Drs W. C. Radford and M Turner (ACER)
L G. Dale (JSSP)
R H. Wilkinson (University of Melbourne).

Those people considered that "the estimates in the submission of the cost of the project and the time needed to carry it out were the most realistic that it was ...ple to make at present".

It was understood that the States were required to provide the equivalent of $90,000 per annum. Mr Reed said that Victoria would be responsible for $60,000 of that amount and that the other two States would provide $30,000

At the meeting, it was agreed to establish a management body called the "JSSP Committee of Management", consisting of one representative of each of the three State Ministers, of the Commonwealth Minis. and of the ACER, with the Project Director as executive officer. Their function was to act "as a representative of the Governments associated with the project, considering such policy questions as expenditure of funds, staffing, and publication of materials" The establishment of a central advisory committee (to advise the Project staff on professional matters) and advisory committees in each State were recommended.

The meeting was informed that "the Commonwealth Minister was writing to the New South Wales, Queensland and Western Australian Ministers of Education to invite their participation in the project. The meeting participants noted that, should any of these States agree to contribute to the project, there might not necessarily be a concomitant reduction in the contribution to be made by the three States participating at present because the inclusion of another State and the need to take that State's particular needs into consideration might increase the cost of the project" (Minutes of Meeting). Western Australia decided to contribute to the project and New South Wales and Queensland sent observers.

A further meeting convened by the Commonwealth for June 1969 was attended by:

A. P. Anderson (Commonwealth Department of Education & Science)
H K. Carey (New South Wales Department of Education)
J. Ford (Victorian Department of Education)
A. O McPherson (South Australian Department of Education)
Dr W. C. Radford (ACER)
G. Robins (Queensland Department of Education)
J. G Scott (Tasmanian Department of Education)
Dr R. L Vickery (Western Australian Department of Education)

Mr McPherson was appointed Chairman for a period of 12 months With the addition of the Project Director (Mr. H. O. Howard) at a meeting in September 1969, this became the Committee of Management responsible for management and administration and with responsibility to governments for .ficient control of the Project, including control of expenditure of funds A proposed Professional Committee was to act as an advisory but not a controlling body With Mr McPherson ill, Mr Ford was elected as deputy-chairman

It was decided that the Director and staff of the expanded Project would not be bound by what had been produced by the existing JSSP and that the materials to be produced could represent a new or different approach The central objective of the Project was the production of a consistent set of materials suitable for use through Years 7 to 10.

Although it was confirmed that the Director and staff of the Project were regarded as part of the staff of the ACER for the duration of the Project, this was not followed later. ACER accommodation was assured until the end of 1969 only and was suited for a small staff. An offer by the Education Department of Victoria for the use of "Glenbervie" (an old mansion in Toorak) was to be considered (depending upon the rental) as the Project location after 1969.

Representation between the States in senior appointments was considered desirable. The principle that strengths in some positions could make up for deficiencies in others was accepted The meeting considered that too many appointees from one State could lead to a limitation of ideas. No doubt this also reflected a concern for the acceptability politically of Project materials should any one State be perceived as dominant

Two Assistant Directors were appointed following interviews held in July 1969. L. G. Dale had been selected as Assistant Director (Development) and Dr G. A. Ramsey was offered the position of Assistant Director (Evaluation and Services).*

New South Wales and Queensland decided to participate in the Project. Mr Carey announced the commitment of $34,320 by New South Wales. The establishment and roles of a Central Advisory Committee and of State Advisory Committees (SACs) were considered. The composition of a Central Advisory Committee was one of each of the following:

- educational psychologist;
- specialist in science education,
- sociologist;
- professional scientist;
- representative from each of six SACs, nominated by the Ministers,
- representative from the ACER.

This Central Advisory Committee had the power to co-opt to a maximum of 15 members It was decided further that the JSSP staff could attend without voting power. However, this decision was not implemented.

Project Director, Howard, envisaged two stages a planning conference to establish broad guidelines; and "normal running" involving advice about how the Project was conforming to the guidelines

A six-day planning conference involving no more than 30 people was planned. (At a Project Committee of Management meeting in November 1969 this was re-titled as the "Guidelines Conference)

* L G Dale had been Director of the JSSP and was involved in postgraduate studies, based on Piaget's work
Dr Gregor A. Ramsey had just completed his doctoral studies at Ohio State ...ersity, based upon a chemistry curriculum project and its effects

With the participation of all States in the Project, and on the suggestion of Commonwealth Department representative, A P Anderson, it was decided that contributions by the States to the JSSP should be on the same basis as their contributions to the ACER Dr Radford advised that, if the total of State contributions was to be $90,000 per annum and in accordance with the existing formula applied to ACER, then the annual shares of each would be

New South Wales	$34,320	South Australia	$8,040
Victoria	$24,840	Western Australia	$6,480
Queensland	$13,200	Tasmania	$3,120

By this November 1969 meeting, all senior positions except that of Area Specialist Geology had been filled and advertisements for writers had elicited 12 enquiries It was decided at the meeting to re title the Project as the "Australian Science Education Project" Dale reported that "this was due largely to a desire to make a fresh start, free from any constraints due to adoption of JSSP policy or procedures A crucial factor influencing a name change was that publishers F W Cheshire held an option on the publication of Grade 7 and 8 JSSP materials In itself, the latter was not sufficient reason for change but, had Grades 7 and 8 material been extensively changed, Cheshires could have had an unfair advantage over other publishers" (Dale personal communication)

As senior Project staff considered the premises at Glenbervie suitable, their use as Project headquarters from April 1970 was negotiated at a cost of $15,300 per annum for rental and maintenance

The same meeting also was significant because of the wide-ranging discussions about the possible influences of State curricula upon Project materials, funding levels and sources and about the purposes and management of the Project There were detailed discussions concerning Project provisions for teacher education. Commonwealth Government representative Anderson advised that "whereas it was unlikely that funds for inservice training in respect of published materials would be available to the Project directly from the Commonwealth, they may be available to the States"

Concerning content parameters, Anderson cautioned the Project not merely to accept existing State curricula. Dr Radford asserted that "the outcomes of the associations between Project staff and the Advisory Committees, and the outcomes of the ASEP Guidelines Conference, would ensure the production of materials from which various possible courses could be selected and followed"

On budgetary matters, the Project submission stated that the $1.2 million needed for the three-State Project would be inadequate for a six-State Project if the same amount of service was to be given Project Director Howard advised that certain costs (such as those of Committee of Management meetings and staff travel) were greater because of six-State participation Chairman Ford stated that "if the money would not be enough to allow the same level of service, the level of service would have to be adjusted "

Commonwealth representative Anderson stated that it was unlikely that the Commonwealth would agree to an increase in funds. However, he pointed out, "the six States were each contributing less than had been envisaged in the original three-State submission and might be expected to meet any additional costs". Because skills were being developed that would benefit science education and the users of the Project products, Tasmanian Scott suggested that the Committee should seek supplementary funding via donations from industry and commerce in the vicinity of $0.25 million Anderson considered that the Commonwealth would agree and, so, the Project Director later asked Anderson to make preliminary enquiries about the possibility of having donations to ASEP made tax-deductible

The purposes of the Project were stated at the meeting by the Committee as.

(1) To develop instructional materials in science for use by teachers and pupils at Grades 7-10 in Australian schools

(2) To carry out such evaluation of current practices in a cross-section of Australian schools as is necessary to ensure that Project materials are tried in a variety of situations where the characteristics of the school, teachers, and students have been adequately described

(3) To produce suitable evaluative and descriptive instruments designed for use with Project materials

(4) To develop a model of a teacher education program for the implementation of Project materials in schools, and implement it in conjunction with teacher education authorities throughout Australia, and

(5) To establish a specialist resource service for the developers of Project materials, for trial teachers in schools, and for other teachers interested in Project materials but who may not be using them in the trial situation.

An outstanding priority was accorded by all States to purpose number 1 above.

The Project staff submitted a proposal for the reorganisation of its management structure and staffing. The new plan included 35 professional and technical staff (contrasted to 30 under the former scheme). This increase was considered justifiable in terms of the service of the Project to six rather than three States Three more Area Specialists were proposed (one for each of Production, Services and Teacher Education), as well as a librarian and an extra Teacher Liaison Officer. Also, changes were proposed in titles from Test Constructors" to "Research Officers" and from "Writers" to "Materials Development Officers".

The Committee of Management members stressed their desire "to ensure that there should not be excessive engagement of manpower for the Projec , was decided that the proposed reorganisation be approved, except that, under the Assistant Director Services, the number of Area Specialists should not be more than three and that not more than one Teacher Liaison Officer should be appointed

The Committee considered a Project submission proposing a modus operandi and timetable relating to output, based on the earlier submissions to the Commonwealth:

(1) *Production of original materials for Grades 9 and 10 of similar quality and extent to those already available for Grades 7 and 8, and concurrently production of additional materials to supplement the existing Grades 7 and 8 materials, both to improve their usefulness and to provide more units to cater for different State requirements*

(2) *Production of similar supplementary materials for Grades 9 and 10 (this could be done at the same time as 1 above)*

(3) *Revision of the existing Grades 7 and 8 materials to give a consistent approach through Grades 7-10.*

There was discussion about whether the Project should continue as a revision of Grades 7 and 8 of JSSP material or make a fresh start. Dr Radford recalled that the submission to the Commonwealth, which had been shown to all States which participated, had a revision of JSSP material as a basis He argued that this seemed to be the best basis on which to plan at that stage, the alternative was to start afresh, with a possibly long delay in reaching a consensus There were discussions about whether existing materials were defunct, whether the Project should start at Year 7, 8 or 9, and the desirability of making a decision before the Guidelines Conference.

The Committee considered the Estimate of Expenditure for fiscal year 1969-1970. Anderson observed that the program covered five years but did not involve increased funding beyond $240,000 per annum in later years. Project Director Howard said the estimates were based upon nine months each in the first and fifth years, with the central period of three whole years as the peak activity rate. Howard stressed that a uniform funding rate would result in a deficit during the middle years of the Project. Anderson said that, providing the States did similarly, the Commonwealth could provide its share at a rate sufficient to prevent the need for an overdraft and that the Commonwealth would meet its share of salary rises. Additional funds could be requested when current funds were exhausted.

GUIDELINES CONFERENCE

In January 1979, a significant meeting of 45 scientists and educators from around Australia was convened at Monash University for the Guidelines Conference for the Australian Science Education Project. The Conference was organised to.

give an opportunity for wide ranging discussion among Project Staff, Project advisers, and a divergent group of professionals interested in curriculum development. (ASEP, 1970, p. 5)

A complete summary of the important considerations of the Guidelines Conference and an evaluation of its effectiveness by participants has been reported

by Ramsey in ASEP (1970). This section builds from that document and examines the role of the Guidelines Conference within the framework of the whole Project The effectiveness of the Conference as a strategy for establishing priorities and directions at the beginning of a curriculum development project is explored. The four aspects of the Guidelines Conference addressed below are (1) the origin and purposes of the Conference, (2) its structure and organisation, (3) the significance of its outcomes and (4) its general effectiveness as a planning process.

Origin and Purposes of Guidelines Conference

There was little documentation concerning the initiation of the proposal for a "Planning Conference" for the "expanded JSSP" (as ASEP was known in 1969). The proposal arose from discussions within the ACER/ASEP internal Advisory Committee of Management. A detailed outline of the proposal, including a statement of purposes and apparent advantages, was prepared by senior Project staff in September 1969. The proposal was accepted by the Committee of Management at its meeting in September 1969. That meeting defined the general purpose for the Conference to be "to facilitate planning of a science curriculum for Australian junior secondary schools" (Committee of Management, September 6, 1969). The term "curriculum" within the above statement was defined by the Committee to mean.

the framework of educational ideas, principles and assumptions developed in conjunction with a set of broad objectives in science education and upon which detailed courses of study and syllabuses can be based (Committee of Management, September 26, 1969)

In terms of that definition, Dr Radford contended that the product of the planning conference "should be a total curriculum as a basis for Project effort". He believed that the proposed Planning Conference, "where differences would be made clear and reconciled as far as possible, would provide the starting point for later developments" (Committee of Management, September 26, 1969).

Three broad purposes of the Conference were:

(1) to present proposals and feasible possibilities for a national science curriculum project for Australian schools

(2) to formulate guidelines and recommendations to help determine the direction of development and evaluation of a science education program for Grades 7-10

(3) to establish the requirements of the States and determine the roles of the States and State bodies in the national curriculum project (Appendix B, Committee of Management, November 21, 1969)

The Committee of Management focussed upon determining the needs and functions of the participating States As Carey (NSW) asserted, "the States will want materials appropriate for their own use" and "to know how to provide guidance and exercise control over the materials being provided for them" (Committee of Management, September 26, 1969) Dr Vickery (WA) urged pre-planning so that representatives could bring views from their States.

Hence, Dr Radford suggested that the State Advisory Committees:

should be established almost immediately to enable them to discuss science education as they see it in their own States and to prepare for the national planning conference. (Committee of Management, September 26, 1969)

Dr Radford also proposed that the planning conference could lead to the establishment of the Central Advisory Committee for the Project.

The proposal for the Guidelines Conference appeared to stem from the desire to provide materials to meet the requirements of six States each with different curricula and administrative organisations This contrasted with approaches adopted in the USA. For example, both the Biological Sciences Curriculum Study (BSCS) and the CHEM Study Project incorporated within their development process "steering committees" which met regularly throughout the life of the projects to provide basic directions (Grobman, 1968) However, the initial directions for the Australian project were to be established by a single national planning conference. One should not "overlook the role of the State Advisory Committees which, with the quiet demise of the Central Advisory Committee, became more important until such time as they were unable to cope with the flow of trial materials" (Howard, interview, 1972).

Radford proposed "that the planning conference could achieve its aim in six days" (Committee of Management, September 26, 1969). This Guidelines Conference was seen to have political advantages, given the State-by-State situation within which ASEP was committed to work. The Committee of Management considered that a national planning conference was "essential (in order to use) the best people available in Australia" (Committee of Management, September 26, 1969) The intentions for the Guidelines Conference were to.

(1) bring together people from all Australian States in an atmosphere of co-operation and with sufficient available time and facilities to enable complete concentration on the task,

(2) be much less expensive in time, and probably money, than a series of one day conferences over several months, or visits by seven staff to each State and the holding of State meetings;

(3) facilitate the work of the Central Advisory Committee by providing them with a concentrated and comprehensive exchange of views;

(4) enable the early establishment of a feeling of involvement by all States and the development of co-operation since the emphasis will be on common principles of science education and not on between-State differences. This should provide a firm basis for the operation of State Advisory Committees,

(5) provide the project with a firm basis for the early commencement of operation. The project staff cannot effectively plan the materials to be developed to fit the curriculum until the planning of the curriculum has been completed. (Appendix B, Committee of Management, September 26. 1969)

Little is recorded of Committee of Management discussions concerning the appropriateness of a single national planning conference. Department of Education and Science representative Anderson asked if it would be possible to gather views in other ways than by having an expensive conference. He was concerned that the planning conference might focus upon the general aims of science education and therefore not be of great value (Committee of Management, September 26, 1969).

With its members basically representing their State Ministers of Education, a major concern of the Committee of Management was the need for the Guidelines Conference to define the roles of the States in the Project The belief was that, if the conference were held in January, then writing could probably begin in May, since the Project staff would continue planning for about three months before writing began. It was believed that the Guidelines Conference would save the Project at least four months of planning time

Structure and Organisation of Guidelines Conference

The general rationale of the Conference as expressed by the Committee of Management implied its structure and organisation:

> *At the Conference, a set of proposals regarding the possible directions such a project may take will be presented by the executive officers of the project. Parallelling these proposals, a series of papers will be given by persons outside the project, so that an alternative perspective may be considered along with the proposals The gathered assembly will react to both papers in syndicate sessions in the afternooon, and in the evening a set of guidelines and recommendations will emerge to guide the executive in their future actions. (Minutes)*

The Conference was therefore structured to cover the following five main topics.

(1) an overview of Australia's educational requirements - trends and issues,
(2) the aims and objectives of a materials development project,
(3) the possible alternatives for materials development and the outcomes to be expected;
(4) the possibilities and promises of evaluation of a junior science project,
(5) the implications of a national project to the States and the nation.

It was proposed that guidelines and recommendations should be finalised on the final day and that a summary of the conference be provided.

The above sequence of topics shared some similarities with the traditional curriculum components of Taba (1962), namely

(1) sources of objectives;
(2) statement of objectives,
(3) selection and organisation of learning experiences,
(4) evaluation procedures.

Thus the Project was viewed by the executive as a curriculum development project. Also the Project represented an attempt to apply in practice some aspects of a theoretical model of the curriculum development processes.

The conference program included.

Day 1 General Survey of Trends and Issues in Australian Education (W. C. Radford)

Day 2 Curriculum Development in Other Places (P J Fensham)
The Purposes and Aims of ASEP (L. G. Dale)

Day 3 The Kinds of Material to be Developed to Foster the Aims of ASEP (G. A. Ramsey)
Learning and Instruction (M L. Turner)

Day 4 Evaluation, Services and Teacher Education to be Provided by ASEP (G A Ramsey)
Evaluation - Wider Perspectives (L. D. Blazely)

Day 5 The States and ASEP - Conveners of State Advisory Committees
Conference Outcomes Statement

There was a concerted effort to ensure representation from all Australian States (c.f , Table 2) and to achieve broad educational, scientific and community representation at the Guidelines Conference, whilst still keeping the Conference within manageable size limits The intention was to have 30 participants in residence and 10 other non-residential participants.

TABLE 2: Number of Participants at Guidelines Conference by State (Excluding ASEP Staff)

State	Number Attending
Victoria	16
New South Wales	6
South Australia	5
Tasmania	4
Queensland	2
Western Australia	2
	35

However, many invitees did not accept For example, in this non-acceptor group were the heads of the Australian Council of Trade Unions, the Australian Chamber of Manufacturers and the Victorian Police surgeon. Representativeness has been criticised by Ramsey because of the lack of females, of overseas project personnel, of psychology and sociology practitioners and of non-university scientists (ASEP, 1970). The place of employment of the actual participants is categorised in Table 3.

TABLE 3: Number of Participants at Guidelines Conference by Place of Employment

Place of Employment of Participants	Number
Staff of ASEP	10
Professional Officers of State Education Departments	8
Staff of ACER	6
Science Teachers	6
Scientists at Universities	4
Members of University Education Faculties	4
Headmasters or Deputy Headmasters	3
Lecturers at Teachers Colleges	3
Education Officer, ABC	1
	45

The input of papers by significant leaders in science education was an educationally important aspect of the Conference. However, it seems that the overriding purpose of the Guidelines Conference lay in its political importance, especially in the sense of achieving interstate credibility and academic respectability.

A summary of the Conference outcomes was reported by Ramsey in ASEP (1970):

The stated outcomes of the Conference give a superficial appearance (of consensus) Many contentious issues were glossed over or concealed in the statements which are at times value-laden, ambiguous or platitudinous . .

Too much time was spent trying to get agreement on opposite viewpoints, and trying to reach consensus on the precise phrasing of statements at the plenary sessions. (p.39)

The discussion summaries of the syndicate sessions largely support Ramsey's generalisations. Concerning the aims of the Project, for instance, one syndicate reported that "violent disagreement occurred between some members of the group" (Syndicate Session, Thursday). Most of the comments reported by the syndicates concerned merely semantic issues and, sometimes, only syntactic rearrangements of sentences (c f , Syndicate Session, Thursday).

Represented among the participants was an educationally interesting diversity in philosophies of science education In opening the Guidelines Conference, Chairman T. J. Ford referred to the "wide and deep" range of talent and commented on evaluation issues:

We can only hope that because of its diversity it does not come to uncomprising [illegible]uations nor to compromises which produce a nebulous charter for the [illegible]oject.

The project may never be able to make an adequate measure of its own success, may never be able to convince its sponsors and consumers as to whether it is a success or not. (ASEP, 1970)

Typical of the spectrum of views reflected in the report of the Guidelines Conference (ASEP, 1970) were:

We believe that education, as well as being for living, is part of living (Howard)

The priorities of objectives for ASEP which appear to be emerging from this Conference have, I think, a somewhat disturbing resemblance to the Science for life sorts of programmes that were common in the UK and US about 20 years ago (Vickery)

I think that it is vital that we reach some compromise between flexibility and rigid sequences, a compromise that will allow an acceptable freedom of choice while at the same time allowing for the development of the hierarchical and structured development of important scientific concepts. (Vickery)

Howard (interview, 1972) considered the Guidelines Conference to be of minimal usefulness for guiding subsequent executive decisions at ASEP, but found the Conference acted as a sounding board for ideas being formulated

How can one evaluate the usefulness of the Guidelines Conference as a strategy in the development processes of ASEP? One measure of its significance would appear to be the extent to which it provided a basis for the further work of the Project. Ramsey (ASEP, 1970, p. 39) concluded that the outcomes document generated by the Conference "does not, for the most part, constitute a useful basis for action". He did outline, however, what the outcomes were. Ramsey considered that it helped to:

(1) identify the problems or questions which have to be resolved.

(2) indicate how much support exists for each of the various known solutions or answers,

(3) approve initial procedures for the Executive,

(4) request that, when the Project produces answers, those be circulated for criticism and comment

Ramsey reported that the general arrangement consisting of presentation of papers, followed by discussion syndicates, then plenary sessions appears to have been a satisfactory procedure on the whole (ASEP, 1970, p 37) He added that the Conference was "overworked" in that the program allowed "little time for informal discussion, for perusal of reference material, and in particular for reading and digesting the syndicate reports before the plenary sessions" Ramsey proposed that the removal of evening sessions in such a conference would have allowed for the additional time needed.

Ramsey (ASEP, 1970) disputed the efficiency and usefulness of the Conference procedure of having papers read to the gathering and of the papers being distributed to the audience during discussion He proposed instead that papers should have been pre-distributed and that a set of questions should have been prepared by each speaker so that conference participants could indicate those they wanted answered by the speakers.

Ramsey noted that the questions for discussion in tne syndicate sessions were often not well-phrased and that three-hour discussions were probably one hour too long. Of the plenary session, Ramsey contended that:

> *the argument often became diffuse and protracted, at times the sessions tended to become dominated by a few strong personalities, later items on the agenda often received a hurried passage due, in part at least, to exhaustion of the participants. (ASEP, 1970, p. 38)*

Syndicate sessions were provided with a set of "headlines" developed by the ASEP executive to guide their discussions along directions for which guidance was sought; these headings largely shaped the reports which were produced

It was Ramsey's view that the Conference achieved a number of desirable purposes:

> *The Conference enabled opinions to be exchanged, and it enabled ASEP staff to obtain a feeling for this climate of opinions, in a way that would not otherwise have been possible The Conference served a number of useful purposes, other than the stated ones (e g , the mutual education of the participants, and the production of important initial contacts between guest participants and Project personnel). State representatives met and were introduced to ASEP, and a general feeling of commitment was engendered. (ASEP, 1970, p 39)*

Thus, several unanticipated objectives were also achieved by the Guidelines Conference In an evaluation of the Conference, Dale claimed that the first purpose (namely, to present proposals and feasible possibilities for a national science curriculum project for Australian schools) was achieved, and that the second purpose (namely, to formulate guidelines and recommendations to help determine the direction of development and evaluation of a science education program for Grades 7-10) was partly achieved Purpose 2 was partly achieved in that three main proposals (from Howard, Dale and Ramsey) were accepted by default (i e., they were not discarded and it was generally agreed that they were feasible and acceptable). Also, a third purpose (namely, to establish the requirements of the States and determine the roles of the States and State bodies in the national curriculum project) was partly achieved

In terms of the political and educational outcomes of the Guidelines Conference, the total budget of less than $5,000 (Committee of Management Minutes, September 26, 1969) for 40 participants for a six-day conference was a small price to have paid

AIMS OF ASEP

Although in the 1980s one still finds substantial support for the view that objectives play a crucial role, findings from an ERDC-funded national research project ("Curriculum Action Project") raised serious doubts about the validity of these assumptions and the importance of statements of objectives for affecting classroom practices as perceived by school personnel.

Around the period (1969-72) when ASEP materials were being developed, however, there was an encompassing climate concerning the purported importance of statements of aims. This was in part due to the influence of the **Taxonomy of Educational Objectives** (Bloom et al , 1956) which was strongly promoted through universities in Melbourne at that time. Curriculum theory had been interpreted (perhaps misinterpreted!) as suggesting that statements of objectives were

(1) prerequisites to effective curriculum development and materials development,

(2) necessarily to be expressed in highly specific terms, with a strong lobby pushing for "behavioural statements" both for guidance of writers and for evaluation purposes.

Therefore, it is perhaps not surprising that, throughout the life of ASEP, staff placed considerable emphasis upon and gave considerable time to the formulation of statements of objectives

In this section, three levels of statement of aims and objectives are distinguished "aims", "broad objectives" and "specific objectives" Aims are considered to relate to the Project in general Objectives are considered to relate to particular units. The aims of the Project derived from those enunciated by VUSEB for the JSSP to the final statement of the aims of ASEP in the positions documents, are considered.

In the 1968 Proposal to the Commonwealth Government seeking funds for an expanded JSSP, M L Turner attached VUSEB s (1967) **Circular to Schools** which outlined the aims of the course in science for which the JSSP was established to develop materials. Four aims were stated, namely, the development of·

(1) an understanding of the universe as conceived of by scientists,
(2) some understanding of the scope and nature of science,
(3) certain skills important to science;
(4) certain attitudes relevant to science.

These aims were discussed and interpreted and a corresponding set of behavioural objectives was derived The aims encompassed the cognitive, affective and psychomotor domains, as envisaged by Bloom and colleagues (1956)

These aims were the basis upon which the expanded JSSP was proposed. By 1970, when the expanded project had changed to reflect the participation of more

States, these aims had been revised. At the Guidelines Conference, ASEP Director Howard presented a rationale and revised statement of the aims, and stated.

The executive would like to have been able to base Project activities on established positions relating to the philosophy, aims, goals and objectives of Australian education. This has been proved to be impracticable it is therefore necessary to declare the beliefs, shared by members of the executive, which might constitute the value judgements on which the work of the Project will be based. (ASEP, 1970, p. 4)

Howard presented the platform of premises upon which his formulation of the fundamental aim of the Project was based That aim was stated by Howard in the following way:

We believe the fundamental aim of the Project is to provide science-linked experiences which help the child to develop intellectually, to grow in his understanding of his environment, and to increase his ability to cope with any new environment as an autonomous, self-directed individual. (ASEP, 1970, p. 8)

Howard's statement varied from the VUSEB (1967) set of aims In particular, his aims emphasised the importance of the individuality of the learner and of the need to relate science experiences to life situations. It retained an emphasis upon the individual's "understanding of his environment" and implied a set of skills, at least those related to adapting to new situations. However, Howard's aim had less stress upon the affective domain.

At the Guidelines Conference, many changes to Howard's fundamental aim were accepted The following six "headings for discussion" presented to the syndicate members in part determined the focus of the modified aims on the importance of the following:

(1) personal development of the pupils,
(2) pupils' immediate environment and interests,
(3) future needs of the individual in society,
(4) the great body of scientific knowledge and processes;
(5) separate scientific disciplines;
(6) the demands of higher secondary and tertiary education.

From the discussions of Monday and Tuesday evenings at the Conference, a number of statements representing "a synthesis, compromise, summary, elaboration, or work of fiction" from the contributed papers were prepared as a first draft of the "Aims of ASEP", namely·

(1) Science education can and should contribute to the personal development of the individual in aspects of social responsibility and by contributing to the achievement of greater self-reliance, independence, flexibility and creativity. The program should embody experiences which lead towards the development of the child as a social being.

(2) *The pupil's immediate environment and interests should be important determinants guiding the types of materials selected and the methodology employed. For some students and for some topics, the materials should stem from the creation of a relevant environment and the stimulation of new interests.*

(3) *The program should be concerned with preparing students to take their place in future society and to make a responsible contribution to it. Future needs should be met by suitable experience of present trends and changes*

(4) *Science is both a structured and dynamic body of knowledge and an array of intellectual skills by which the information is obtained and interpreted. The big ideas and the major processes of science should be basic determinants of the content and the range of instructional procedures of the program. These two dimensions are of equal importance, but this balance between them and their relationship to the other major aims of personal and social development and relevance to the students' immediate environment may change from stage to stage and may be different for students of different ability. The final balance should emerge from the development of the program.*

(5) *While the traditional disciplines do exist and represent meaningful deviations in content, we do not believe that the separate disciplines should be the basis of the structure of the program. We believe that important ideas and methodologies are inter-disciplinary and will emerge from an integrated approach directed towards giving the student a unified and structured understanding of his environment.*

(6) *The requirements of a science project at this level should not be determined by the demands of higher education. The program should be determined by the objectives appropriate to students at this level. Cognisance must be taken both of the needs of the majority of students for whom the course is terminal and of the needs of some students for whom this course is a preparation for higher study*

Following the acceptance of the first draft of the aims of the Project, Dale (ASEP, 1970) made a number of recommendations concerning the nature of the materials to be developed. His recommendations had crucial implications for the clarification of the Project aims. Dale proposed that materials should:

(1) *be concerned mainly with the current development of children who would not continue with the formal study of science;*

(2) *relate directly to the child's present environment as far as possible, including its physical, biological and social aspects,*

(3) *be consistent with the structure of scientific knowledge and contain aspects devoted specifically to extension of this knowledge treating science as an integrated subject;*

(4) *follow an enquiry approach and develop competency in scientific enquiry;*

(5) aim at developing positive student attitudes.

By these additions, Dale indicated a move towards a specification of the general nature of the science content which children would be required to learn and illustrated an interest in the affective domain, although the kind of attitudes to be developed were not detailed.

A further amendment to the aims of the Project was made by a statement prepared by Noel Wilson (then of ACER), who suggested that science classroom experiences should contribute to the personal and social development of the child and, in particular, should promote:

- a balance between independence and interdependence in problem solving situations;
- a commitment to enquiry as one mode of operation in life situations,
- a willingness to adapt, to be flexible, in new situations.

A syndicate session led to the replacement of the first statement of the first draft of aims by Wilson's statement. No other major changes in the substance of the aims was made.

The final statement of aims which emerged from the Guidelines Conference represented a synthesis of views expressed during the Conference. Subsequently, in the second **ASEP Newsletter** in 1970, the aims were re-stated more succinctly

ASEP should design science experiences which would contribute to the development of the child. Materials will help children to:

(1) Acquire skills and concepts that will encourage them to try to interpret their physical and biological environment

(2) Initiate and pursue their own inquiries while keeping a balance between their needs and obligations as individuals and as members of a group

(3) Adapt to change

(4) Care about the consequences of scientific developments

(5) Develop creativity.

The final statement of ASEP's aims was presented in Position Document 13 (ASEP, 1970) As a curriculum development project, ASEP had as its broad aim to design science experiences which would contribute to the development of children. More specifically, the science experiences were aimed at developing.

(1) Some understanding of man, his physical and biological environment, and his interpersonal relationships,

(2) Skills and attitudes important for scientific investigation;

(3) Some understanding of the nature, scope and limitations of science.

SUMMARY STATEMENT

The emergence of ASEP as a nationally funded project acceptable from State-to-State from the initially one-State project (JSSP) was an educationally and politically significant development in Australian education Initial associations with the Australian Council for Educational Research (ACER) helped to submerge the interstate rivalries of the State Education Departments. The subsequent representativeness of all States on both the ASEP Committee of Management and at the Guidelines Conference reflected sensitivity to the continuing State responsibilities for and control of matters educational The early attention given to the aims of ASEP reflected the preoccupations of that era with statements of aims, but also helped to crystallise the philosophy and directions of ASEP. If practised in classrooms, ASEP's emphases upon individual differences, flexibility of content and sequence and levels of student involvement would help to refashion classroom science teaching practices in highly desirable directions away from the traditional didactic "chalk and talk" classroom which largely ignores individual differences and experiential learning

This chapter and the previous one together provide a historical backdrop to the establishment of ASEP and some of its rationale for guiding the nature and development of ASEP units. In Chapter 3, ASEP is considered in terms of the important distinction between curriculum processes and products

NOTE: Documentation for Chapter 2 is contained within ASEP files and archives, as well as within staff questionnaires administered by a Macquarie University team which visited ASEP Headquarters in 1972 The former are now held by the Curriculum Development Centre, Canberra, the latter have been placed by David Cohen in the Curriculum Resources Centre, Macquarie University

CHAPTER 3

CURRICULUM PROCESSES AND PRODUCTS

Now that a historical perspective on the development of ASEP has been provided in the previous two chapters, there remains only one further set of preliminary considerations in this chapter prior to moving on to a detailed description of ASEP's curriculum development and evaluation processes in Chapter 4 and 5 The purpose of this chapter is to draw distinctions between curriculum processes and products and between curriculum projects and school-based curriculum decision-making and to consider ASEP in terms of these distinctions.

As discussed in Chapter 1, during the 1960s and early 1970s, there had emerged in Australian States a reconsideration of the merits of centralisation in curriculum decision-making. An alternative or supplementary set of strategies for curriculum decision-making is a regionalised or school-based function. Concurrently, there was evolving a more critical appraisal of what "curriculum" really meant and of the processes and products of curriculum activities.

During the 1970s, there were growing demands in both the United Kingdom and USA to provide evidence of the impacts resulting from the investment of substantial funding in curriculum development activities during the 1960s In the United Kingdom, the Schools Council for Curriculum and Examinations commissioned an "Impact and Take-up Project", whilst a conference in the USA was held with the major objective of stimulating "constructive ideas on the kinds of studies that could best evaluate the impact the National Science Foundation has had on science curriculum development in the United States" (Lockard, 1975, p. 2). The demands stemmed from some disenchantment and scepticism about the longer-term impacts of these overseas curriculum developments and from increasing demands that educators should be held responsible for the investment of funds in projects

There was also the emerging recognition that **curriculum products** (such as syllabuses, textbooks, audiovisual resources and other so-called curriculum materials) by themselves neither could revitalise nor energise curricula, nor could they be the source of innovation or initiation of curriculum change This recognition had led to new insights concerning the importance of what have been labelled as **curriculum processes.**

Quite early in the history of Australia's Curriculum Development Centre (CDC), when designating "Council Priorities and Guidelines" for its Triennial Program 1977-79, CDC expressed its interest in

> *studies of curriculum process (decision-making), which will entail attention to teaching-learning variables, organisational factors, support structures, etc*

In the same document, CDC expressed its concern

> *to consolidate and strengthen existing approaches whose value has been clearly established It is vitally interested in the assessment of existing practice in so far as implications for future action may be drawn from this assessment and it will foster the study of new paradigms and models for the curriculum (Curriculum Development Centre, 1977, p. 8)*

This interest of CDC in pursuing such studies was reflected in their commissioning of the present ASEP Processes Study. This was seen by CDC as a "case study of the curriculum development processes followed by a significant Australian project, complementing the now completed ASEP implementation and evaluation studies, and the review of research" (CDC Project Profile No. 50, 1978).

TERMINOLOGY AND FEATURES: "PROCESSES" AND "PROJECTS"

Before considering the curriculum processes used in the Australian Science Education Project, it is important to delineate how the terms "processes" and "projects" are being used and to describe some of the features of each.

Curriculum Processes

In general terms, in contrast to curriculum "products" (i.e. **what** is produced as a result of curriculum discussions and activities), the term curriculum "processes" is concerned with the study of the decision-making procedures, the criteria used for making decisions and the personnel involved, as well as with the activities, assumptions, methods and data used (Cohen, 1973a, p. 1).

Essentially, then, the study of curriculum processes is concerned with answering questions relating to **how** and **by whom** curricula are developed, implemented and evaluated The term "processes" includes the actions of individuals and/or the interactions which occur between members of a group, including those used during its deliberations, and the methods in which participants engage as they move towards and make decisions.

In other words, curriculum processes are concerned with how a group reaches its decisions and how it functions. This includes the social and emotional aspects of the contributions of individuals and of the group as a whole as it progresses through its tasks towards its products The parameters for describing curriculum processes are concerned with decision-making and include communications and other forms of interactions, supports and tensions within a group, the degree of structure, leadership styles in a group and also aspects of cohesiveness and consensus-reaching These are not mutually exclusive dimensions but interactive aspects of how groups function Likewise, the processes are also likely to be intrinsically related to the charter, tasks or curriculum products of the group. Effective progress towards task achievement is facilitated when individual and group energies can be directed towards the task This often occurs after interpersonal understandings have been reached and group members feel support within a group.

The following questions further define the parameters of the curriculum processes:

- What constitutes a decision?
- What decisions are made about curriculum?
- Who is involved in making curriculum decisions?
- How do the people interact (if they do) when more than one person is involved in decision-making?
- How are decisions reached, made or taken?
- What factors, including those internal and external to the decision-making group, influence individuals and the whole group in their decisions?

Project Approach

There are many approaches to curriculum development, based upon a variety of perceptions of what constitutes "curriculum" and **who** should be involved The "project approach" to curriculum development emerged in the late 1950s about the time of the launching of USSR Sputnik. In essence, the "project approach" implies that (1) the curriculum **products** are crucial for improving learning and (2) "experts" will produce better products than classroom teachers.

Many writers attribute the emergence of curriculum projects in the USA to the launching of Sputnik and say that Sputnik heralded the Space Age Supremacy of Russia over USA Such rhetorical claims are easy to make. A chronological coincidence seems to be an equally plausible explanation Since then, the curriculum project has gained substantial support as a strategy for promoting curriculum development The extensive funds available in the USA through the National Science Foundation for improving science curricula were almost solely earmarked for project activities What are the key identifying characteristics of this curriculum approach?

In the context of the 1970s, a particular view of the project approach emerged. This is the setting in which ASEP was established. Grobman (1968, p 4) characterised the curriculum project as referring "to group - in contrast to individual or co-author - efforts to produce some new kind of curriculum, using experimental tryouts of preliminary materials and collating feedback from such tryouts to be used for the improvement of the c iculum prior to its release for general distribution"

So widespread was the influence of the curriculum project in the USA that the term tended to become synonymous with curriculum **development** which, in many ways, is an undesirable confusion. For example, the notable educator, Rosenshine (1970), wrote that.

> *...specific curriculum projects (are) programs in which the instructional materials were developed by special groups such as tbe Biological Sciences Curriculum*

> *Study . . (and) . the term curriculum refers to instructional materials and the suggestions for their use*

A broader view was adopted by Welch (1969, p 429) who defined curriculum as "a set of materials or planned experiences designed to accomplish certain stated or implied objectives" A basic assumption of the project approach is that curriculum change can be stimulated by the production of curriculum materials

Characteristics of the "Project Approach"

The "project approach" as practised in the 1960s and 1970s was characterised by the following features:

(1) A group of people including "experts" (e g., scientists, academics, teachers) are relieved of their normal professional responsibilities and assembled together as a central team outside of schools and classrooms, in a substantial onslaught. This might be in response to specific submissions from special interest groups from within tertiary institutions or professional associations and from people who are sensitive to the way in which the funding bodies or bureaucracies make their decisions. It is often the result of ad hoc bidding for funds for particular subject areas and is rarely considered in the context of the overall curriculum Advocates of the curriculum project approach argued that the employment of a separate development team of experts had the advantages of the use of a source of expertise not likely to exist within a particular school.

(2) The group is formed into one or more writing teams and given the charter to write materials and/or specifications for producing materials which reflect their particular discipline (i.e , materials-oriented task).

(3) The group is provided with special funding (e g., in the USA, by the National Science Foundation funded by the government, in the United Kingdom, by the Nuffield Foundation, a private organisation sponsored by the vehicle industry, in Australia, by the then Commonwealth Department of Education and Science)

(4) The group has a predetermined and limited duration in which to develop its materials, so that the budget must be spent by a certain pre-specified date.

(5) The major function of the group is materials-oriented (e.g , to produce textbooks containing specialised up-to-date content and multimedia resource materials). The production of high-quality project materials and related inservice materials and/or programs would ensure that implementation by classroom teachers would be uniformly good In this connection, Popham (1969, p. 319) wrote that:

> *Examination of the curriculum reform movement (in USA) during the 1960s reveals that, without exception, those curriculum projects which had the most significant effects upon educational practice produced curriculum materials to implement their new curriculum scheme.*

Relatively little of the budget for most curriculum projects was allocated for the dissemination of ideas, teacher education programs or the evaluation of the impact of the project materials.

(6) In several projects, and especially in the early stages of materials development, there has been trialling within schools and some feedback from these trials is provided in a variety of forms to the developers or funding agency. Usually, the project approach has involved the production, trial, modification and publication of materials designed for student and/or teacher use to convey a particular approach to the curriculum for large numbers of students (Cohen, 1974)

(7) When the agreed-upon materials have been developed or when the budget has been expended (generally which ever occurs first), the project team is disbanded. The materials then might be handed over to commercial or governmental agencies for publication, promotion and sale

(8) As with centrally-developed curriculum initiatives generally, the extent of usage and fidelity of usage of the curriculum project materials in real classrooms can vary significantly from developer intentions.

(9) Where projects have received government funding, often there are demands for accountability in the form of improved student performance and/or evidence of the impact of the resultant materials. The use of a separate team of evaluators can help ensure the credibility and objectivity of the evaluation.

(10) In general, the adoption of the project approach results in the three curriculum "phases" becoming the responsibility of three distinctly separate groups These groups are (a) the centralised "expert" team in curriculum development, (b) classroom teachers in curriculum implementation and (c) an "outsider" group as evaluators (e.g., university academics) in curriculum evaluation.

The strategies used by ASEP represented a highly centralised approach to curriculum development and, in many ways, modelled the project approach described above. Even the Materials Development Officers responsible for writing the ASEP units for use in classrooms had virtually no input into some of the crucial decision-making processes concerning the philosophy of ASEP. These decisions had been predetermined largely by the senior staff of ASEP, with some deriving from the ASEP Guidelines Conference

However, ASEP staff tended to treat the documented philosophy to a large extent as a general 'atmosphere' or backdrop against which to write Writers were not too constrained by this, feeling that they had a large degree of freedom in planning the units.

The general framework was considered to be mostly helpful, but its interpretation varied with time and staff changes. It was at times determined by who happened to show up at particular meetings. This early phase of one year in establishing the basic philosophy and procedures was seen by overseas project workers as a

crucial advantage which ASEP had by contrast with USA and UK projects (Edwards, personal communication, 1982).

There was implicit within the structure of the staffing patterns of ASEP a preservation of the four disciplines of science (Biology, Chemistry, Geology and Physics), insofar as Area Specialists were appointed in each of those four areas prior to the appointment of Materials Development Officers Such appointments suggest accountability pressures for the development of units in each of those four areas, despite the purported underlying philosophy that ASEP was to be built around environmental studies and that all units were to reflect an integrated approach. However, in general, the particular appointees had wider interests and were able to reflect the more integrated approach

School-Based Curriculum Development

A noteworthy contrast to the project approach is the concept of school-based curricul· m development (SBCD) as introduced into all Australian States and Territories in the last two decades SBCD, at least in its idealised form, implies the acceptance of the trinity of functions - development, implementation and evaluation - within schools by the whole staff acting together as a group (see Figure 1).

FIGURE 1: Some Contrasts Between the Project Approach and School-Based Curriculum Decision-Making

Curriculum Strategies	Phases of Curriculum: Development	Implementation	Evaluation
Centralised Curriculum Project Approach	Headquarters team	Teachers (receive curriculum materials)	Another group of evaluators (e g., outsiders, project-devised instruments)
School-Based Curriculum Decision-Making (SBCD)	Group of those affected make school-based curriculum decisions about adoption/adaptation/creation of development, implementation and evaluation procedures		

In particular, advocates of SBCD have argued that the extent of involvement of teachers during the curriculum **development** stages is correlated highly with commitment to and fidelity of usage of the curriculum and any related materials during the **implementation** stage.

There is accruing evidence that participation in the curriculum processes of decision-making leads to a commitment to the use of the products evolved as a consequence of these processes In other words, when one views curriculum development as both a set of products **and** a set of processes, the effectiveness of

implementation needs to be evaluated in terms of both **uptake** (including both purchase and effective use for student learning) and **commitment** among teachers using the curriculum to improve their approaches to teaching and learning in classrooms. The effectiveness of implementation does not depend solely, nor even necessarily crucially, upon the appealing and glossy presentation of documents and other products It depends very heavily upon the involvement of potential users in the processes related to curriculum decision-making. It follows also from these considerations that the uptake and survival of curriculum materials cannot result solely from administrative edict (Note that this was powerfully if not traumatically illustrated in the report on the "Primary Science Scheme for the Territory" by Cohen, 1977. Despite the provision of expensive and elaborate materials, teachers generally were ignorant about both the materials and the underlying science teaching philosophy. As a consequence, the materials still had not been introduced into many of the classrooms of the Northern Territory two years after their official "implementation" and, thus, the project had not achieved the intentions of its developers.)

It is arguable, too, that the impact of project materials is much broader than their adoption in classrooms as the developers had intended. Research at the Australian Council for Educational Research (ACER) and at Monash University on the adoption of ASEP materials illustrated a wide diversity of classroom practices during the use of particular ASEP units (Owen, 1978). The research provided evidence that ASEP materials were undergoing adaptation by many classroom teachers It is likely, too, that ASEP materials have been the springboards for the **creation** of a new generation of science materials.

Especially in view of their sensitivity to the time-demanding nature of teacher engagement in curriculum development activities, the above description of the "adopt/adapt/create" stimuli is regarded by many proponents of school-based curriculum decision-making as an important array of alternatives in curriculum development and implementation. Useful research tools, strategies and concepts for viewing curriculum implementation were developed in the 1970s by Hall and his co-workers at the University of Texas R & D Center (Hall & Loucks, 1977) In particular, the Concerns Based Adoption Model (CBAM) and the Levels of Use (LoU) concepts help in researching and describing the adoption and fidelity of usage during the implementation phase of externally-developed curricula

It has also been argued that the involvement of teachers in the processes of curriculum evaluation is likely to promote self-evaluation and self-reflection activities which have the advantages of providing immediate feedback Such feedback allows for continual modification of the curriculum concurrently with its implementation.

SUMMARY STATEMENT

Perceptions related to the terminology of the curriculum studies field vary widely. Some meanings of the terms "processes" and "projects" were reviewed The project approach and school-based curriculum decision-making represent two widely differing but complementary approaches to curriculum change. The focus in

this present ASEP processes study is to provide a full account of the procedures used in the Australian Science Education Project (ASEP) and to draw implications concerning the effectiveness and role of the "project approach" as a strategy for curriculum change. In mounting this study, it was considered that the processes of ASEP might yield useful guidelines for curriculum development generally. In the following two chapters, ASEP's curriculum development and evaluation processes are considered in detail.

C APTER 4

ASEP'S CURRICULUM DEVELOPMENT PROCESSES: THE 38 STEPS

Following several introductory and background chapters, the present chapter has as its purpose the description of the curriculum processes by which ASEP units were developed. Questions to be addressed within this chapter include.

- What decisions were made?
- Who participated in the decision-making?
- What factors influenced the decisions?

Owen (1978) noted that little work had been conducted on the documentation of the processes involved in the development of the ASEP materials, despite the fact that ASEP was the first national curriculum project to be established in Australia under sponsorship of both the States and the Commonwealth govemments. Documentation of the processes involved in the development of ASEP materials might enable any future curriculum work to avoid some of the problems experienced with ASEP and to benefit from ways and means which were shown to be effective.

For the sake of convenience and comprehensiveness, the development of each ASEP unit can be considered retrospectively in terms of a 38-step framework, reproduced in one of the ASEP documents, involving the development and writing, evaluation and production of the unit. In this chapter, after a brief consideration of staffing at ASEP, each of the steps and the curriculum processes involved in each step are discussed.

ASEP STAFFING

The staffing of ASEP was directed towards a teamw. approach in developing 41 units Consensus of decisions was preferred to individual efforts. As Ramsey (1974, p. 12) indicated, it was thought that "you were less likely to make bad decisions in a consensus situation. If you cannot justify your position or proposal to another person, then you will think twice about implementing it" However, Ramsey (1974, p. 8) also acknowledged that there had been limited success in implementing the teamwork approach. He wrote that "people tended to work more as individuals who came together occasionally to discuss their work" Perhaps lack of knowledge about **how** to develop teamwork, he said, brought about this situation

Former ASEP staff member Edwards (personal communication, 1982) agreed that staff at ASEP tended to work as individuals. "There was, at the same time, a very supportive environment at ASEP. One had to take one's plan for any unit to a

large staff meeting and defend it And these meetings could be very tough and frustrating What they did was to constantly air people's attitudes and biases, and from this one could build up a general set of expectations To this extent, a type of consensus evolved. However, many of us were strong individuals, and as in any group, certain personalities dominated The management structure set up some 'us and them' situations as the Project wore on and the physical setting predisposed certain types of interaction. The Materials Development Officers (MDOs) on adjacent desks, or in the same room, became closer to you, so you often sought their advice or reactions. So in this respect, there was cooperation The relations between individual MDOs and individual Area Specialists were often complex and at times strained or aggressive" (Edwards, personal communication, 1982).

The staff itself was divided into two branches, each under the direction of an Assistant Director. These two branches were

(1) **the development branch,** responsible for the development and writing of the instructional materials in the units. Within this branch worked an Area Specialist in each of the fields of physics, chemistry, biology and earth science Each Area Specialist worked with a team of writers. (The processes by which staff were appointed are discussed below.)

(2) **the service branch,** responsible for the production of the materials, their trialling and evaluation. This branch was also responsible for the teacher education program. Employed in this branch were an Area Specialist in each of the fields of evaluation, teacher education and services, and production, and a group of Research Officers, technicians, Teacher Liaison Officers, librarian, editors, artists, photographers and printers

However, as Ramsey (1974, p. 5) indicated, this staff structure was not stable. As priorities for the Project changed, from planning to writing to evaluating the production, people had to change from one function to another, or staff who had completed one function had to drop out and new staff to fulfil another function had to be employed Thus, the staff at ASEP might be viewed as a floating population. Indeed, only three or four people stayed with the project the whole time (Ramsey, 1974, p 5) This floating population caused the problem of productivity loss resulting from the need for introduction of new staff to the ASEP philosophy and methods Although the formal induction period varied over the life of ASEP, it generally took six months for a writer to become proficient

At the same time, new appointees provided new insights and enthusiasm and often questioned established practices This frequently had a constructive impact by helping to clarify procedures and concepts.

THE 38 STEPS OF ASEP

As indicated in the introduction, ASEP produced a document depicting unit development as comprising 38 steps. Figure 2 depicts the 38 Steps in ...ammatic form. In fact, this illustration is the one published in ASEP's

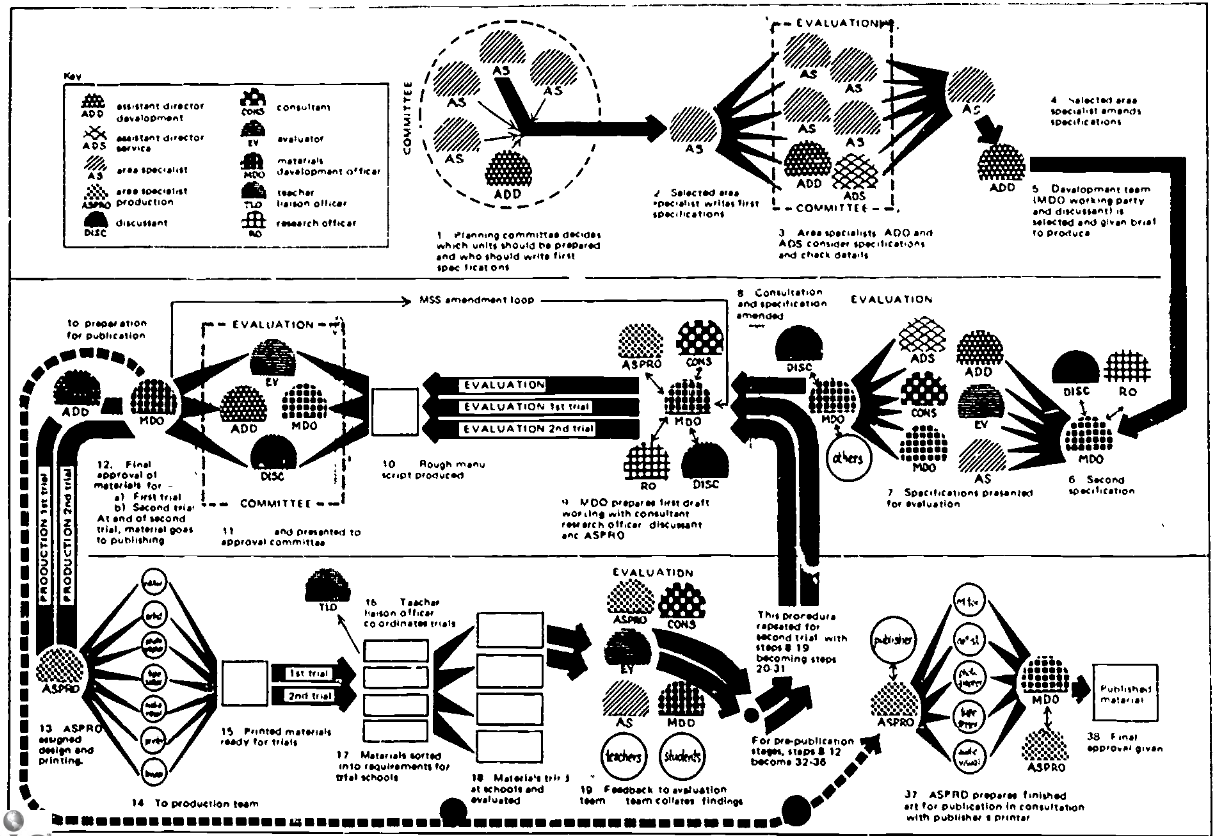

FIGURE 2: The 38 Steps in the Development of a Unit

Newsletter Number 3 (July 1971). This figure shows which personnel were involved at each stage and illustrates how some of the steps related to the first draft of a unit were later repeated for the second and third drafts

Former Assistant ASEP Director Dale told us:

The 38 ASEP steps were based on the experience of the JSSP team modified and improved to meet the conceptual requirements of ASEP - mainly in terms of the evaluation and feedback components required, and of demands of the production schedule.

An overview of the 38 steps involved in the development of an ASEP unit is provided by Table 4 which lists each step. This table shows that some of the steps followed in producing the first version of a unit were repeated when developing the second and final versions. In particular, Table 4 shows that Steps 8 to 19, as followed in relation to the first version of units, were repeated for the second version in Steps 20 to 21. Similarly, Steps 32 to 36 for the third (or final) version of a unit are a repetition of Steps 8 to 12. Consequently, there were only 21 distinct steps (namely, Steps 1 to 19 and 37 to 38) involved in developing an ASEP unit.

Yet the 38 steps were not formally imposed upon ASEP staff, as Dale wrote.

The 38 steps were seldom referred to as such. They were a background scheduling device rather than a consciously used indicator of the stage of development of a unit. More commonly, the progress of a unit was described by such terms as "at second specification stage", "now developing first trial version", undergoing evaluation after second trial", "being prepared for final publication". (Dale, personal communication)

Edwards (personal communication, 1982) reinforced that view. Whereas the 38-step diagrammatic representation produced in 1971 might have been an accurate description of the processes at that time, he emphasised that by 1973 things were different in a number of respects. Edwards felt that ASEP provided:

a good example of how expediency (and to some extent experience and expertise) led to modification. ASEP was a living, breathing creature that changed (thank goodness) and I would be disappointed if you gave static representation.

Step 1: Planning Committee Decides Which Units Should be Prepared and Who Should Write First Specifications

A planning committee was established in January 1970 for the purpose of deciding what units should be written and by whom This committee consisted of the Assistant Director Development (L. Dale) and the four Areas Specialists Development with expertise in Chemistry (L Howell). Earth Sciences (B Jarman), Physics (W. Lang) and Biology (R. Shepherd)

When the planning committee first met together, their initial tasks involved reviewing current curriculum materials, both local and overseas, and becoming

TABLE 4: Overview of the 38 Steps in the Development of an ASEF Unit

Step Number	Step Description
1	Planning committee decides which units should be prepared and who should write first specification
2	Selected Area Apecialist writes first specification
3	Area Specialists, Assistant Director Development and Assistant Director Services consider specifications and check details
4	Selected Area Specialist amends specification
5	Development team is selected and given brief to produce
6	Second specification
7	Second specification presented for evaluation
8, 20, 32	Consultation and specification amended
9, 21, 33	Materials Development Officer prepares draft working with Consultant, Research Officer, Discussant and Area Specialist Production
10, 22, 34	Rough manuscript developed
11, 23, 35	Rough manuscript to approval committee
12, 24, 36	Final approval of materials
13, 25	Area Specialist Production assigned design and printing
14, 26	Production
15, 27	Printing of materials ready for trial
16, 28	Teacher Liaison Officer coordinates trials
17, 29	Materials sorted into requirements for trial schools
18, 30	Materials tried at schools and evaluated
19, 31	Feedback to evaluation team and collation
37	Area Specialist Production discusses final art for publication in consultation with publisher's printer
38	Final approval given

familiar with science syllabi and trends in various Australian States. With information gained from these tasks, members of the committee set about selecting topics and proposing initial specifications for the units. In choosing units and their outlines, the following two orientations emerging from the Guidelines Conference were given special consideration:

(1) To treat science as an integrated study,

(2) To follow an enquiry approach and develop competency in scientific enquiry

This reflects the shift in emphasis away from learning a large number of facts about science, to an understanding of a few key concepts that can be applied in different situations These key concepts are used to tie together the content of science

In all, more than 100 initial specifications were written However, by amalgamating some of these and by applying certain criteria, this number was reduced to 50 In particular, the eight criteria listed below were used in selecting which initial specifications would be followed through:

(1) The ideas included should lead to generalizations which enable children to see relationships that they might not otherwise have seen

(2) The ideas must be meaningful to children and they must relate to direct experiences.

(3) The ideas must be potentially interesting to children.

(4) The activities of students must contribute to the development of skills and abilities considered desirable

(5) Precedence should be given to topics in which ideas considered to be more useful or important are developed

(6) The ideas included generally should be able to be dealt with through student activity, preferably handling of apparatus and specimens, observation, use of references, photographs, maps, etc

(7) Simple, readily available equipment and experimental situations should be used where possible.

(8) The ideas, activities and procedures involved should be feasible

Adherence to these criteria ensured that the units reflected the philosophy of ASFP, as outlined in the Guidelines Conference. This conference recommended the following characteristics for ASEP materials.

(1) A balance between independence and interdependence in problem-solving situations;

(2) A commitment to enquiry as one mode of operation in life situations,

(3) Encouragement of a willingness to adapt and to be flexible in new situations,

(4) Reflecting a concern with the social consequences of science and technology.

(5) Fostering the child's creativity,

(6) Developing an understanding of man's physical and biological environment.

Lang (questionnaire response, 1981) indicated that these criteria were decided upon after various members of the team prepared papers and after a series of meetings were held The criteria were selected by consensus of the project staff although, as Dale indicated (questionnaire response, 1981), some criteria were modified by comments made by consultants and others in the participating States.

Finally, the planning committee decided that the proposer of the initial specification should write the first specification

Step 2: Selected Area Specialist Writes First Specification

The Area Specialist Development who proposed the unit initially was the person who wrote the first specification This specification was concerned with how the unit **could** develop The intention of the first specification was to outline ideas to be developed, possible activities, and processes and abilities to be developed in the student As such, it was the first concrete step in the development of a unit.

The first specification was read and discussed by all the Area Specialists before it was finally accepted An example of the information contained in the first specification of the Unit **Mice and Men** is provided in ASEP's Position Document 11

Step 3: Area Specialists, ADD and ADS Consider Specifications and Check Details

The four Area Specialists Development, the Assistant Director Development and the Area Specialist Services met to consider the proposed first specifications against the same eight criteria against which the initial specifications were judged (i e , those outlined in ASEP Position Document 39) Particular consideration was given to the main ideas and core developments to be included in the unit and to the Piagetian stage to which the unit should be assigned. Lang (questionnaire

response, 1981) indicated that decisions regarding Piagetian stage assignment were based on the type of reasoning considered necessary for the child to undertake the unit. Regarding the unit **Charge,** Lang gave the following reason for assigning it to the second stage: "We tried to identify the type of reasoning required, and a stage between concrete and formal thinking was appropriate". Williamson supported Lang's contention and claimed that "the assignment at first specification stage was really only an intuitive guess based on the level of concept development in the unit and the type of learning activities" (Williamson, 1977, questionnaire response). "Assignment to stages was done **after** second specifications or first specifications had been prepared (i.e., was based on unit content and level of treatment). The decision on numbers at each stage was based on the need to have a set of units that gave a reasonable smorgasbord covering Years 7-10" (Dale, personal communication) Also consideration was given at this stage to the length of a unit, format, equipment and references.

By eliminating those specifications not meeting the eight criteria, the 76 units originally proposed were reduced to 41. Such reflective evaluation was an integral part of the ASEP program. In fact, ongoing evaluation was considered a necessary cost-saving factor by Ramsey (1974), who claimed that:

> *We could not, in the Project, afford to produce a unit and then not use it because that would waste our scarce resources. This was why we had an elaborate system of evaluation of the units. . A unit could be thrown out at that stage (first specification) if it did not look to be just what we wanted. If it was thrown out at this stage minimal expense occurred, rather than at a later stage. (Ramsey, 1974, p. 23)*

Step 4: Selected ASD Amends Specification

A written report from the first specification meeting described in Step 3 was forwarded to the Area Specialist Development (ASD) who had written the first specification. This Area Specialist usually met with the Assistant Director Development before rewriting to discuss these recommended changes. Typical examples of the areas in which changes were considered at this stage were the unit's title, equipment and optional activities. When the Area Specialist Development had completed these amendments, they were checked with the Assistant Director Development whose approval was needed before the amended first specification could be accepted.

The first specification, although not formulated in great detail, provided the conceptual framework for the future development of the unit Materials Development Officers appeared to have differing views as to the degree to which this outline could be altered. For example, Jarman (personal interview, 1972) maintains that the first specification could be modified but not altered dramatically, whilst Fisher (personal interview, 1981) indicates that, in one unit which he wrote **(Digging Up Evidence),** the "second specification was nothing like the first specification at all". Edwards (personal interview, 1982) stated that for some units the first specification was closely followed, for others it was not. This depended mainly on the personalities and experiences of those directly involved.

Decisions regarding which units were to be developed and their broad content were in the hands of a relatively small number of staff members, namely, the two Assistant Directors, the Director and the four Area Specialists Development. Nevertheless, as later discussion shows, the ASEP staff became involved in the subsequent modification of these specifications and the writing of units.

Step 5: Development Team is Selected and Given Brief to Produce

As mentioned above, the first specification of a unit provided the **broad** general guidelines on which the second specification was based. In contrast, the second specification was a **detailed** plan or specification of a unit, outlining the precise nature of proposed objectives, learning activities and sequencing of activities within the framework of ASEP's educational philosophy. While the first specification was primarily the responsibility of one of the Area Specialists Development, a development **team** approach was used to develop the second specification. The operation of such teams depended greatly upon the particular blend of personalities and experiences. Step 5 was concerned with the selection of personnel to develop the second specification.

The development team consisted of the following three people.

(i) **Materials Development Officer (MDO).** This person was responsible for the writing of the unit and was appointed by the Assistant Director Development and the relevant Area Specialist Development But the same MDO could be involved with different Area Specialists depending on the subject of the unit. For example, Fisher (personal interview, 1981) indicated that for the unit **Digging Up Evidence** Brian Jarman was his Area Specialist, while for **Plants** his Area Specialist was Ron Shepherd Initially, when selecting an MDO for a unit, consideration was given to vocational background, academic expertise and other relevant talents and interests However, as the Project developed and time and money constraints began to be felt, these criteria were applied less stringently. It was the perception of Fisher (personal interview, 1981) that "you got to do the job because there was no one else to write it at that particular time". However, most units appear to have been developed by the MDOs relatively skilled in the area of the unit. The question of whether to use the same MDO for the second version of a unit was complex. The use of the same MDO provided continuity, commitment and background, but had the potential disadvantages of over-involvement and less willingness to change the unit in the light of feedback from evaluations.

Although the majority of ASEP units were written by a full time MDO, some units were initially written by teams of teachers seconded from schools. These teams, which were drawn predominantly from teachers in various States involved in the field trials of earlier ASEP units, developed materials in the school holidays in rough form to be worked on later by Project staff (Ramsey, 1974). But, in a later interview in 1974, Ramsey indicated that this procedure was not as satisfactory as it might have been Firstly, bringing teams of writers in for short periods was much more costly in terms of money and time than using full-time writers already employed at the Project. Secondly, it took considerable time for the teachers to appreciate the philosophy of ASEP and they were never able to become as totally "soaked" in it as permanent writers were. Furthermore, as with the permanent ASEP staff, these teachers typically had no previous experience in writing curriculum materials.

However, despite these difficulties, Ramsey noted the potential value of having teachers, if properly trained, write curriculum materials as a means of furthering teacher involvement in curriculum change. Also Cohen (1985, p. 1157) indicates that accruing evidence suggests that participation in curriculum processes of decision-making leads to a commitment to the use of the products evolved as a consequence Furthermore, the uptake and survival of materials developed depends heavily upon the involvement of potential users in the processes related to curriculum decision-making.

(ii) **Discussant.** The Discussant, usually the Area Specialist who wrote the first specification for the unit, assisted the MDO by being available to discuss matters of concern to the MDO. However, several MDOs have indicated that the role of the Discussant in the development of the second specification was a fairly minor one. For example, MDOs Ken Williamson **(Atoms)** and Ron Page **(How Many People)** both indicated in responses to questionnaires (1977) that, for their units, the MDO held almost the entire responsibility for the writing of the unit. Page noted that. "Each unit was the 'baby' of an MDO and in general he/she had the final say", while Fisher (personal interview, 1981) commented that the Discussant was "someone to talk to now and again". Somewhat conflicting views were put forward by MDO Sue Jarman (personal interview, 1972), who referred to a meeting at which several MDOs felt that they would like more "freedom" from the Area Specialists and indicated that reallocation of jobs sometimes occurred in an effort to dissipate some of this tension. This fact, added to the frequent changes of staff due to secondments, resulted in many different people acting as the writer of a particular unit at various times, with resulting time wastage and cost increase. But, sometimes allocation of a new writer brought fresh ideas, new insights and significant improvements.

Commenting on the above views about the Discussant role, Edwards (personal communication, 1982) wrote:

> *What is being reflected here is, in effect, evolutionary. In the early phase of the Project, when Sue Jarman was very involved, the Area Specialists in general "took" more power Towards the end, this was no longer possible - partly as a result of the development of skills and confidence by MDOs and partly because of the personalities involved MDOs became much more powerful and autonomous towards the end. I clearly remember an Area Specialist disagreeing heavily with two MDOs near the end of the Project because he still wanted to "have control", but the MDOs said they knew more about their topics and refused to budge. These things were sometimes thrashed out in meetings when second specifications were presented. I repeat it is difficult and perhaps dangerous to try to make generalisations. Some MDOs were much more likely to accept direction than others The above statements by MDOs are much in keeping with how they would have seen it. For me, Ron Page's quote is spot on but, for others, Sue Jarman's quote would be more accurate. I think it is perfectly understandable that different MDOs operated very differently.*

(iii) **Research Officer.** Document 15 indicates that the tasks to be performed by the Research Officer in the writing of the second specification were

(1) To remind the developers of any broad deficiencies in the first specification by relating it to the position documents,

(2) To help in the stating of the objectives for the unit in the second specification,

(3) To coordinate the development of evaluation instruments to be used with the unit.

Research Officers for each unit were selected by the Assistant Director Development and the Area Specialist who wrote the first specification for the unit. Many Research Officers were recent graduates from university with expertise in measurement and evaluation, although these people typically had minimal prior experience in curriculum development

Despite the intention that the Research Officer should make an important input to materials development, some MDOs (e g , Fisher, personal interview, 1981) felt that Research Officers played quite a minor role in development of some units. At the same time, there are examples of Research Officers who made significant inputs (e.g., to the unit **Skin and Clothes).** The Research Officer's time was used largely in clarifying objectives and in writing the diagnostic tests and other evaluation instruments associated with each unit and described in greater detail in Chapter 5.

Step 4 introduced the teamwork approach to curriculum development. However, this teamwork approach towards writing did not always involve the Discussant and Research Officer in assisting the Materials Development Officer to as great an extent as originally envisaged On this point, Ramsey has commented that:

I would have certainly built more strongly on the concept of a small team developing a unit Although we tried to develop teamwork we were not too sure how to do it People tended to work as individuals who came together occasionally to discuss their work We should have strengthened the concept of a small team consisting of a writer, an evaluator with appropriate experience, an artist-audio visual person who could be associated with more than one team at a time, and someone who had a broad perspective of the whole project and the whole range of the units, who would act as the consultant for that range of the units, and who would act as the consultant for that particular item Others could be added to the team to provide special advice, and particularly teachers and consultants (Ramsey, 1974, p 8)

Edwards (personal communication, 1982) presented a different view

Teams can kill individuality and effectively squash the things that give any unit its "personality" While there are obvious advantages in teams, I would rather go for top-class individual "writers" (I prefer the term producers) with support teams available for consultation.

I personally liked the creative freedom which I had. At the second specification meeting there was a check on you, and you also had your Discussant and your Research Officer if you wanted to use them. Units developed by teams can be dull compromises If you fluked a team of creative cooperative enthusiasts that would be great, but such an occurrence is probably rare.

Nevertheless, for numerous units, sufficient genuine collaboration did occur between team members to suggest the potential value of a teamwork approach to curriculum materials writing. Dale (interview, 1981), in particular, felt that ASEP's use of a teamwork approach led to higher average quality across units than otherwise would have been possible.

Step 6: Second Specification

The second specification was a detailed plan of a unit As outlined in ASEP's Position Document 15, the purposes of a second specification were

(1) To give a statement of intent for developing a unit which can be accepted, modified or rejected before too much time is lost or before there has been too much personal involvement

(2) To act as a form of training for the developer and to give the developer the necessary background information for preparing the unit

(3) To give a comprehensive survey of the content, activities and objectives of the unit so that these can be appraised in relation to the position documents

(4) To explore choices among possibilities for the direction of development of the unit. The choices should be outlined in the specification and either pursued in parallel in the manuscript or rejected.

(5) To give an opportunity for consultants and others interested to suggest desirable change in the unit and to comment on the likely validity of the science content.

(6) To give advance notice of any special film, apparatus, photographs or other aids which might be needed so that development of these could be commenced while the unit was being written

(7) To give an opportunity for appraising the best methods of communicating to children the main ideas to be developed.

Document 43 listed the aspects which should have been included in the second specification of any unit

- what the unit is about;
- relevance to the environment scheme.
- the main science ideas included;
- useful background knowledge and abilities;
- ...ks with other units,

- knowledge objectives,
- process, ability and attitude objectives,
- detailed plan,
- references and audiovisuals,
- facilities required,
- style.

Because the MDO responsible for developing the second specification of a particular unit often was not the person who had developed the first specification, sometimes the first and second specifications were very dissimilar. In turn, this sometimes led to some conflict between the MDO writing the second specification and the Area Specialist who had developed the first specification (Fisher, personal interview, 1981).

Step 7: Second Specification Presented for Evaluation

In order to allow for adequate reading and comment, a copy of the specification was circulated to all senior staff (Director, Assistant Director Development, Assistant Director Services and Area Specialists Development) and MDOs about seven days before the second specification evaluation meeting. This evaluation meeting was chaired by the Assistant Director Development. The people supposed to be present at this meeting were the development team, the senior staff, MDOs and several members from the editorial and production staff. However, because of other commitments, a number of staff were not able to attend.

At the meeting, the development team, particularly the MDO, was cross-examined in depth on most aspects of the unit. Particular reference was made to the objectives of the unit, the main science ideas to be included, the value of the unit for contributing to the development of the students and the consistency of the unit with the overall aims of ASEP. Contributions which members made to the meeting varied according to their personalities and power within the Project. For example, the editorial and production staff attended the meeting mainly to familiarise themselves with the unit and to give specialist advice in their particular fields. As the Project advanced, many MDOs were so busy on a number of projects that their potential to contribute in a major way in these meetings was quite restricted.

Key Position Documents were often referred to during this second specification meeting. Questions often required the MDO to defend a specification in terms of its consistency with ASEP's philosophy as set down in Position Documents. For example, the MDO might have had to defend the specification in terms of its consistency with ASEP's aims (Document 35), statement of main ideas (Document 36), choice of topics (Document 39), ways of dealing with subject matter according to children's stages of development (Document 3) or use of the enquiry approach (Document 38). For clarification, Appendix A provides extracts from some of these Documents.

The recommendations from the evaluation meeting were noted by the MDO and a copy of these was sent to the development team.

Step 8 (First Version), Step 20 (Second Version) and Step 32 (Final Version): Consultation and Specification Amended

When the team developing the unit received the report from the second specification evaluation meeting (Step 7), it usually met with the Assistant Director Development to discuss the recommendations from this meeting From the second half of the Project onwards, these meetings were by-passed. Where the intent of a recommendation was unclear, the assistance of the person who originally made the recommendation was sought. Occasionally outside specialist help was required In most cases, however, only minor modifications to the specification were made. The amended specification was then at a stage where the MDO (in consultation with the Discussant and Research Officer) could concentrate on preparing a draft manuscript of the first version of the unit.

Similarly, at later stages, this meeting at Step 20 was used to consider evaluation feedback from the trial of the first version of the unit and to provide approval for writing the second version, whilst the meeting at Step 32 considered evaluation feedback from the second trials and approved the third and final version of the unit for final production. For example, where national trials had revealed that certain equipment needed for a unit was difficult to obtain in some States, the unit's plan had to be changed accordingly. As another example, some units had their Piagetian stage levels altered in the light of feedback information from trial teachers But for units which had also undergone a first trial, major alterations generally were not needed to a specification after second trials (Fisher, personal interview, 1981).

Ramsey outlines the following criteria for revising a unit.

Our major criterion was feasibility in the classroom. There were four main areas we tried to probe. First, what problems were there in its teachability, what would work and what would not work in the classroom? Second, what problems were there in the content, was that accurate or inaccurate? Third, how interesting did the children find the materials, what did they like doing and what did they not like doing? Finally, how practicable was the unit in terms of equipment and other resources or the activities outlined? (Ramsey, 1974, p. 14)

Step 9 (First Draft), Step 21 (Second Draft) and Step 33 (Final Draft): MDO Prepares Draft Working with Consultant, Research Officer, Discussant and ASPRO

The writing of each successive draft of a unit (i e , Steps 9, 21 and 33) was primarily the function of the MDO The Area Specialist Development who wrote the first specification usually was the Discussant. The latter's functions were to ensure that time schedules were adhered to and to evaluate the draft periodically, although the responsibility for decisions made by these people varied among units as described previously Lang (questionnaire response, 1981) indicates that "each Area Specialist wrote one unit to feel what it was like" For example, Lang developed the unit **Charge** for the first trial and then acted as adviser for the rewrite It is true that each Area Specialist was under great pressure with multiple responsibilities at any one time. It was Jarman's experience (personal interview, 1972) that time, pressure and lack of adequate writing staff necessitated that he spent the majority

of his time in writing units, thus minimizing the time he had to discuss and evaluate other units. The fact that Jarman was at the time the sole earth scientist on the ASEP staff probably exacerbated this situation

Commenting on the role of the MDO, Edwards (personal communication, 1982) stated:

> *Most of us loved it It was hard work, no doubt, and it wasn't easy to meet all the criteria set by the Project But I think most MDOs would probably rate their time at ASEP as the most productively creative times of their professional life. I think it would be sad if the excitement and joy were not recorded.*

Most writers experienced difficulty in writing their units, particularly in writing at the appropriate Piagetian level The degree to which the Piagetian base, as opposed to the teaching experiences and commonsense of the ASEP staff, influenced the content of the units is debatable. Certainly there is no empirical evidence to support the validity of the application of Piagetian concepts to curriculum materials development. It is worth noting the view of Edwards who remarked that the actual ASEP units might have more accurately reflected Montessori than Piaget Ramsey (1974, p. 20) says that "writers were forced to write their materials at a level appropriate to the particular stage of the students, and this was for some of them a very difficult matter". These difficulties would seem to indicate the need for skilled writers to be employed in such roles Les Dale (personal interview, 1972) endorsed the adequacy of staff training procedures (Edwards, personal interview, 1982) reported that in the final two years of the Project, little induction was provided for new staff. A particular need identified by Edwards for new appointees was training in communication and design. One of the great weaknesses was the "word-based" nature first drafts written by MDOs The Area Specialist Production (Ray Smith) was able to incorporate improved communication strategies. Some of the MDOs developed their own capacities in this area as a result of on-the-job training.

MDOs also paid particular attention to trying to write materials at a reading level suited to most students Following a survey of readability formulae conducted by one of the MDOs seconded to ASEP on a short-term basis, it had been determined that ASEP units' readability levels would be checked using the Flesch Readability Formula which lays down criteria of readability according to word length, number of syllables per word, numbers of words per sentence and number of sentences per paragraph. Because this formula was developed many years ago in the context of the USA, its validity, relevance and reliability for the Australian scene could not be assumed. Nevertheless, writing for particular Piagetian levels and readability levels were among the restrictions (or "frames") imposed upon MDOs when they joined the ASEP staff Writers were required by the Area Specialists to check their completed materials against this readability scheme While this was quite a tedious task, most writers found that by using words of few syllables and short sentences, little difficulty was found in meeting the requirements of the Flesch scheme Fisher (personal interview, 1981) points out that, having done it once, it became obvious that to write readable materials according to the Flesch scheme, one simply kept

sentences short and avoided using words of many syllables. Edwards (personal communication, 1982) commented

Flesch is a semantic measure of readability and I don't deny it helped to develop a writing style of short words and short sentences. However, I think we should have used the Cloze procedure on our trial materials. After all, it is a measure of functional readability that really matters. I would strongly recommend the use of the Cloze procedure to any project or school-based materials developers. The Cloze procedure involves the deletion of every fifth word of a 275 word sample, whilst retaining the first and final sentences intact Students are then asked to fill in the blanks, and a score is allocated for exact word replacements High scores are found to correlate highly with comprehension.

It was recognised widely that ASEP staff worked under considerable pressure. Ron Page (questionnaire, 1977) claims that there was "almost unbearable pressure" on MDOs who had several units at various stages of development concurrently Further, many MDOs often had to take up writing a unit where another person had left off, resulting in lack of continuity and time wastage on the one hand, but in certain positive outcomes on the other The Area Specialist Production (ASPRO) was consulted by MDOs and others as to the feasibility of producing their ideas and materials.

External consultants were utilised to varying degrees by the writers to advise on the types of materials to be included For example, Sue Jarman obtained much useful information from the State Agricultural Department, C W.L and Walter and Eliza Hall Institute. The degree of use of external consultants depended upon the attitude of each writer. Edwards (private communication, 1982) emphasised the invaluable help of the many willing and able people consulted by him when developing ideas for ASEP units. There is little doubt that community members generally are a most underutilised resource in curriculum materials development.

Research Officers were involved most towards the end of the writing of each unit's first draft. They were concerned most with:

(1) the wording of the objectives for the unit. The writers "tried very hard to write our objectives in a form most useful to teachers" (Ramsey, 1974, p. 18). However, one of the Research Officers felt that the aims reflecting the philosophy of ASEP were so broad that it was difficult to operationalise these aims when writing objectives for the units

(2) the development of diagnostic tests and other evaluation devices. Ramsey (1974, p 18) outlines the importance of testing procedures as a component of the learning process when he says "We endeavoured to prepare diagnostic tests wherever possible and student self-checking tests wherever possible. We had a very definite philosophy that tests were an integral part of the learning process."

In the writing of a unit's second draft (Step 21) and third draft (Step 33), extensive use was made of the feedback information from the trials described later In particular, the MDO obtained guidance in rewriting from a collated report of all

evaluative information, inspection copies annotated with comments by outside consultants and trial teachers, and the MDO's own impressions from observations and discussions during visits to trial classes

Step 10 (First Version), Step 22 (Second Version) and Step 34 (Final Version): Rough Manuscript Developed

The development team organised the typing and assembling of a rough manuscript consisting of the following:

- core;
- options,
- tests;
- record books,
- teachers' guides.

The format of the manuscript varied from development team to development team Included in the manuscript were such components as diagrams, activity frames and photographs An important feature of the manuscript was to give the production staff an indication of how the team considered the unit should be presented. As time passed, increased coordination between writing and production staff short-circuited these formalities

For the second and third drafts of a unit (Steps 22 and 34, respectively) this rough manuscript was essentially a cut-and-paste version of the previous version. This was not always so, particularly in cases where a new writer was involved. Some pages had words changed and typing errors corrected. Other pages were completely rearranged. In other instances, complete sections were removed and new sections inserted. As Fisher (interview, 1981) indicates, the galley proof was changed quite a bit, with every page of the unit being rewritten. The way this often was done was to cut out the page that had been used before, paste it onto a foolscap size page and make all the alterations on this.

Step 11 (First Version), Step 23 (Second Version) and Step 35 (Final Version): Rough Manuscript Presented to Approval Committee

Although the intention was for this step to involve a carefully chosen committee approving the rough manuscript prior to going on to the next steps, no approval committee, per se, actually existed. The MDO and Discussant for the unit progressively discussed and amended the rough manuscript. When final agreement on the manuscript was reached by these two people, the manuscript was presented to the Assistant Director Development for his approval. In the majority of cases, he approved the manuscript, albeit with minor modifications

Step 12 (First Version), Step 24 (Second Version) and Step 36 (Third Version): Final Approval of Materials

It was at this stage that the editor for the unit began to play an important role. After receiving a copy of the rough manuscript, she examined it thoroughly and noted recommended changes. She was concerned primarily with communicative

effectiveness, reading difficulty and adherence to style conventions. Several MDOs (e.g., Page, questionnaire, 1974) claimed that working with the editor was a significant learning experience for MDOs. Edwards (personal communication, 1982) suggested that logic and clarity were improved greatly in this process as was the communication style of the MDO.

The MDO and editors then met and discussed these recommendations By consensus between these two parties, the manuscript was amended to facilitate the production of materials which reflected the development team's intentions "in as good a communicating state as possible" (Betty Gorrie, editor, questionnaire. 1972). However, editors involved in ASEP indicated that they felt "too much had to be done in a relatively short time" and that units had to be produced under "rushed circumstances" Gorrie considered that "perhaps it would have been better had they got down to writing much sooner - and spent less time documenting what they were **going** to do This would have sorted problems out more quickly and the faults in the theory would have surfaced much earlier."

These comments appear to reflect the MDOs' thoughts about the intense pressure under which units were produced in comparison with the manner in which the philosophy and broad aims of ASEP were formulated more slowly. This "slow start" had the great benefit, as documented earlier, of providing a well-planned basis for unit development

The above procedure was repeated at Step 24 when the second version of a unit was approved and again at Step 36 when the third and final version was approved. But, because Step 36 involved the final manuscript which was to be presented to an outside publisher, very careful editing was carried out at this stage.

When the second version of a unit was being designed by the production team (Step 25), evaluative feedback from the first trial was used to guide changes in layout and design of the unit These changes were determined by discussion between the MDO and the ASPRO These changes included such items as better quality photographs, improved or more accurate diagrams and illustrations and the like. These changes were then re-checked by the MDO and the editor to ensure their correctness

Within the Project, however, there did appear to be some lack of communication of results from the evaluation meeting to the production team, although the ASPRO was present at this meeting In particular, photographers, illustrators and other production staff often seemed to receive little direct feedback from this evaluation meeting.

Step 13 (First Version), Step 25 (Second Version): ASPRO Assigned Design and Printing

The MDO and the Area Specialist Production (ASPRO) worked together to develop a "mock up" or model of the first or second version of the unit This model included diagrams, photographs, booklets, student guides and teacher guides to be included in the unit For two units (**Metals** and **Solar Energy**), games were also ...uced.

Conflict sometimes occurred between the ASPRO and the MDO as to the most suitable way to present unit material As Fisher (personal interview, 1981) indicates, this conflict created some problems between development and production staff. Consensus between the ASPRO and MDOs was arrived at often only with difficulty. The positive effect of the ASPRO (Edwards, personal communication, 1982) and his staff on the ultimate quality of ASEP materials highlights the crucial role the production staff can play in such a project They usually worked concurrently on several units which produced high stress levels and difficult conditions both for creative output and harmonious relationships with develop .s.

Step 14 (First Version), Step 26 (Second Version): Production

Once the materials for the units had been designed, the ASPRO allocated the tasks necessary for the production of the first version (Step 14) or second version (Step 26) of units to the following members of the production team

(1) **Graphic designer** responsible for the layout of the materials,

(2) **Photographers** who took and developed photographs under the direction of the MDO,

(3) **Artists** responsible for the illustrations in the unit materials,

(4) **Media and equipment specialists** concerned with liaison with the commercial firms producing audiovisual materials and laboratory equipment for the Project;

(5) **Printer** responsible for printing the trial materials

At this step, agreement between the ASPRO, artists and MDOs had to be negotiated There were problems of conflict between scientific accuracy and attempts to find the best way of communicating by illustrations and diagrams to students At times, the group had to find solutions to very difficult communication exercises (e g , diagrammatic representation of metallic bonding) At other times, there were professional disagreements concerning the "best' way of communicating particular ideas or concepts.

It should be noted that the printing of trial versions of the units was conducted within ASEP headquarters According to Ramsey (1974), the reasons for this were that

- the ASEP team wanted to be involved in the whole thing from start to finish and not lose control of the material
- the format of a unit was just as much part of the trial as the material of the unit,
- it was cheaper to produce materials in this way

Lang expresses similar feelings in that she "found that working with an editor and an artist on the same premises is very much better than handing a manuscript to a

publisher and having editorial comments made at a later stage" (Lang, questionnaire, 1981).

Step 15 (First Trials) and Step 27 (Second Trials): Printing of Materials Ready for Trial

All student materials (instructional booklets, tests, photographs, additional material) and teacher materials associated with the first and second versions of units were printed, collated and bound at ASEP headquarters. The number of copies produced was sufficient to cover the needs of all trial schools and to allow some additional copies to be sent to such people as members of the Committee of Management, State Education Department representatives and selected interested people in tertiary educational institutions Because of the volume of units produced by ASEP, the printing of these materials was quite a sizeable task.

Step 16 (First Trials) and Step 28 (Second Trials)· Teacher Liaison Officer Coordinates Trials

Since the purpose of the first trial was to test the validity and feasibility of units during actual classroom use, the Teacher Liaison Officer was responsible at Step 16 for:

(1) selecting the trial schools and teachers from volunteers,

(2) arranging for trial teachers' induction seminars at ASEP headquarters involving speakers such as the relevant Area Specialist, the MDO and the Research Officer connected with the unit to giving brief talks on the content of the unit, evaluation techniques and feedback required from the teachers,

(3) arranging meetings at which teachers provided ASEP staff with feedback on how the unit was progressing

The role of Teacher Liaison Officer as a separate person disappeared during the first two years of ASEP and the tasks were added to those of the MDOs.

Criteria used to select teachers for the first trial were willingness on the part of the teacher to cooperate fully in the program, expertise in teaching, proximity of the school to ASEP headquarters, assurance that the class would be available for the duration of the trialling period and willingness of schools to make provision for teachers to attend training sessions (Document 19)

Document 19 details the purposes of the second trial as being to

(1) refine the structure and presentation of individual units,

(2) establish or confirm necessary prerequisites for teachers and students using a particular unit,

(3) determine the suitability of a particular unit for different teaching situations,

(4) train a group of teachers to be experienced in Project philosophy and the use of Project materials.

In particular, the second trials helped to identify whether there were any State differences that needed to be taken into account in the final version of units.

Since the second trials were national, their successful implementation depended to a large extent on assistance from other organisations in each State (Document 19). It was in this capacity that the State Advisory Committee played a major role. This committee appointed a State Trial Coordinator who, along with the Teacher Liaison Officer, was responsible for the national trials The State Trial Coordinators selected the trial schools (from those volunteering for the task) and coordinated the trials. As well, they were responsible for organising and conducting the induction courses to introduce teachers to ASEP philosophy and to conduct the post-trial seminars.

Step 17 (First Trials) and Step 29 (Second Trials): Materials Sorted into Requirements for Trial Schools

Trial materials for each unit were collated into **trial class sets** consisting of over 30 copies of all materials intended for student use and **inspection sets** consisting of one copy of all student and teacher materials The materials were distributed to:

(1) **Trials teachers.** Each teacher received one class set and two inspection sets. One inspection set was to be returned with comments to ASEP after completion of the trial. In the case of the national trials (Step 29), State Trial Coordinators were responsible for distribution of materials in their States.

(2) **ASEP staff, library, files, evaluators, display and ACER.** One inspection set was distributed to each of these.

(3) **Committee of Management.** One inspection set was sent to each member of this committee.

(4) **State Advisory Committees.** Ten inspection sets were sent to the chairman of each State Advisory Committee. Comments were invited from these people.

(5) **Overseas.** Inspection sets were sent to a few science education centres overseas.

(6) **National and State libraries.** Libraries received inspection sets.

(7) **Teacher training institutions.** Some institutions involved in the training of science teachers were sent copies of units

Step 18 (First Trials) and Step 30 (Second Trials): Materials Tried out at Schools and Evaluated

Because of the importance of this step involving the collection of evaluative information during trials and of the following step involving the collation of this

information, Chapter 5 of this report is devoted entirely to these areas Consequently, these steps are outlined briefly here for completeness while the reader is referred to Chapter 5 for greater detail.

The majority of ASEP units underwent two trials, although time and financial stringencies necessitated that some units received only a second trial, and one unit received only a first trial **(Minerals and Crystals).** The first trial involved approximately eight classes in schools accessible to the ASEP headquarters in Melbourne, this enabled close contact to be maintained between trial teachers and ASEP staff On the other hand, the second trials were national and were coordinated in each State by a person appointed by the relevant State Advisory Committee Typically over 20 classes were involved in the second trials

As Chapter 5 shows, a variety of types of evaluative information was collected during both the first and second trials This information included experts' responses to structured questionnaires, experts' unstructured comments, meetings of trial teachers and ASEP staff, trial students' responses to structured and unstructured questionnaire items, results of student achievement tests and visits to trial classes by ASEP staff To a greater or lesser extent, each of these sources yielded information which was useful in guiding the revision of materials.

Step 19 (First Trials) and Step 31 (Second Trials): Feedback to Evaluation Team and Collation of Findings

The evaluation team, under the direction of the Area Specialist Evaluation (Ken Moritz), collated and analysed the feedback information from all sources and prepared an evaluation report for each unit. As Chapter 5 shows, this feedback information ranged from the frequencies of different responses to structured questionnaire items aggregated across large samples to the listing of all open-ended comments made by various outside consultants and trial teachers The way that this feedback information was used in the rewriting of units also is discussed in Chapter 5.

Step 37: ASPRO Discusses Final Art for Publication in Consultation with Publisher's Printer

This was the first stage at which the outside publisher of the final version became involved. In fact, Step 37 is analogous to Steps 14 and 26 except for the involvement of the outside publisher.

In order to ensure that the materials were of a suitable standard for publication, minor changes were made to photographs, diagrams, illustrations, etc. This procedure was carried out by ASEP's Area Specialist Production (ASPRO) in consultation with the outside publisher's production staff In particular, these changes were guided by feedback information obtained during the second trials of units.

Step 38: Final Approval Given

The final step simply involved senior ASEP staff in approving the third version, together with the last changes to artwork, for transmission to the external publisher [illegible]roduction in final published form.

DISCUSSION

Chronologically, documents describing the 38 Steps appeared after several units had passed through many of the stages. Consequently, the 38 Steps represents an articulation and formalisation of a process of curriculum development which ASEP staff previously had evolved, put into practice and found useful (Williamson, questionnaire, 1978).

The 38 Steps model was based in part upon the Assistant Director Development's previous experience with the Junior Secondary Science Project (Dale, personal interview, 1981). But, as Dale also notes, the evolution of the 38 Steps scheme was influenced substantially by input from ASEP staff and external consultants to the Project Furthermore, in Dale's opinion, the 38 Steps provided an excellent ideal model for ASEP's curriculum development procedures, although short cuts were found to be needed in practice to reduce the amount of time involved in following all steps Fishe. personal interview, 1981) found the 38 Steps scheme useful because it helped him with organising his time deadlines and anticipating what activities and staff would be involved in subsequent stages. Williamson (personal interview, 1981), while acknowledging merits of the 38 Steps scheme, pointed out that the existence of such a scheme restricted flexibility in that all units had to follow the same sequence of development steps.

The 38 Steps was found a particularly useful device by the Director and Assistant Directors for organising the timing of different stages in the development of units. With so many units being developed simultaneously, it was found necessary in the interest of efficient use of resources to ensure that deadlines were placed on the preparation of specifications, writing of units, production, trialling and return of feedback from trial schools. These deadlines were perceived necessary so that production resources were kept in regular use, so that trial schools knew when materials would arrive and need to be returned, etc Consequently, from the point of view of the Assistant Director Development, the 38 Steps was a "background scheduling device" (Dale, personal interview, 1981) which facilitated the coordination and pacing of ASEP's complex unit development work

The existence of strict time schedules was reacted to differently by different Materials Development Officers For example, Fisher (private interview, 1981) appreciated the need for deadlines and found the pressure quite acceptable. On the other hand, other writers (e g , Shepherd, letter, 1974) found the time pressures unacceptable and felt that sometimes the educational quality of materials had to be compromised in order to meet deadlines. The ASEP experience, then, highlights the need in complex curriculum development ventures to strike an appropriate balance in which deadlines are sufficiently rigid to ensure reasonably efficient use of scarce resources but still provide enough flexibility so that educational quality is not seriously compromised.

It was mainly the senior administrative staff (Director and Assistant Directors) who were concerned directly with the 38 Steps scheme as a whole. For these staff, the 38 Steps not only assisted in planning and scheduling ASEP's development activities, but also proved a useful conceptualisation of the Project to portray to newly arrived ASEP staff and to external audiences. On the other hand, other ASEP

personnel (e.g , production, editorial, teacher liaison staff) were concerned mainly with the small number of steps and associated deadlines related specifically to the particular areas. Even Materials Development Officers, although responsible for meeting the deadlines associated with a sizeable number of steps, still had no need to maintain an interest in all 38 steps. In fact, one Materials Development Officer (Lang, questionnaire, 1981) was unsure of what was meant by the term "the 38 Steps" when responding to a questionnaire

A major merit of this chapter is that it has served to identify and sequence the large number of distinct stages involved in the development of each ASEP unit. Although not all stages in the 38 Steps necessarily would be included in all curriculum development initiatives, this chapter's description of the 38 Steps in the development of ASEP materials could provide useful guidance to others embarking on curriculum development work In particular, the present chapter could serve to make others aware of the complexity of curriculum development work and help people identify and sequence those steps which are likely to be followed in their own work.

CHAPTER 5

EVALUATION OF ASEP MATERIALS

The previous chapter was devoted to the 38 Steps involved in the production of ASEP materials An overview of these 38 Steps is provided in Chapter 4 in both tabular form (Table 4) and diagrammatic form (Figure 2) However, because of the importance of the specific steps involving the collection and collation of evaluative information during field trails (namely, Steps 18 and 19 in the first trials and Steps 30 and 31 in the second trials), the present chapter is devoted to a comprehensive discussion of the evaluation of ASEP materials

INTRODUCTION

In a recent book from the Stanford Evaluation Consortium, Cronbach and colleagues claim that

> *Evaluators gain much experience in the course of designing and redesigning a study. Unfortunately, little of that experience is recorded for the benefit of the evaluation community . Methods of evaluation would improve faster if evaluators more often wrote retrospective accounts - (Cronbach et al, 1980, p. 214)*

Moreover, Anderson and Ball (1978, p 101) note that what exists in the literature in terms of reports of evaluation efforts almost exclusively focusses on summative evaluation, while reports of formative evaluation efforts are particularly scarce One reason for this, of course, is that summative evaluation reports serve wider audiences, whereas formative evaluation reports are likely to be of interest predominantly to the curriculum developers themselves. Nevertheless, a portrayal of the formative evaluation procedures which were followed by a specific curriculum project potentially could provide valuable guidance to others embarking on formative evaluation initiatives

The formative evaluation activities associated with the Australian Science Education Project (ASEP) are among the most comprehensive employed in any Australian curriculum venture. Consequently, in an attempt to enlighten others involved in formative evaluation, this chapter aims to describe, illustrate with concrete examples and draw implications from the formative evaluation activities associated with ASEP

A recent study of the self-evaluation efforts of teachers involved in school-based projects funded under the Innovations Program of the Australian Schools Commission showed that the concept of formative evaluation was foreign to a large proportion of teachers and that relatively few teachers used any form of systematic

evaluation to guide improvements in their ongoing projects (Fraser & Edwards, 1982). The potential contribution that formative evaluation can make to the continuous monitoring and improvement of school-based curriculum development initiatives is unlikely to be realised unless teachers can be given some practical guidance in this area Consequently, by drawing on the formative evaluation experiences associated with ASEP, this chapter is likely to provide valuable guidance to teachers attempting the formative evaluation of their school-based curriculum development initiatives

In order to facilitate understanding of later discussion of ASEP's evaluation procedures, this section provides relevant background information and delineates the scope of this task In particular, consideration in the following subsections is given to (a) the focus of the present chapter in terms of the 38 Steps, (b) the distinction between student and curriculum evaluation, (c) the range of evaluation methods useful in formative curriculum evaluation, (d) evaluation vs dissemination and (e) the organisation of field trials.

Focus of Present Chapter in Terms of the 38 Steps

Cohen (1973a,b) has drawn valuable distinctions between **reflective** evaluation, **summative** evaluation and **formative** evaluation. Reflective evaluation comprises a preliminary screening of curriculum components and involves a subjective assessment of their suitability Summative evaluation involves assessing the overall effects of a curriculum unit after it has been developed Formative evaluation involves the gathering of information which can be used to guide the revision of preliminary versions of curriculum materials

Chapter 4 provides detailed discussion of those six steps of the 38 Steps which involved reflective evaluation conducted prior to field trials to provide preliminary information to guide the development and modification of units These six steps, which are included in Table 4, involved a group of ASEP staff in scrutinising each unit's first specification (Step 3) and second specification (Step 7), and the presentation and approval of the first trial version and later the second trial version of materials to ASEP's academic staff (Steps 11 and 23) and editorial staff (Steps 12 and 24) These steps involving reflective evaluation were found to provide a rather economical way of evaluating, eliminating and modifying units at an early stage prior to incurring the expense of production and field trials (Ramsey, 1971).

Since ASEP's main charter clearly was the development of materials, the primary goal of evaluation within ASEP was the formative one of guiding the ongoing development and revision of materials The summative evaluation of individual or groups of units therefore was perceived as being of relatively minor importance, although it served two functions First, summative information indicating that a unit was considered worthwhile on the whole (despite the existence of specific weaknesses requiring modification) was important to many of ASEP s Materials Development Officers for sustaining and motivating their materials writing efforts. Second, the informal dissemination of ASEP materials that took place at many levels in part made use of global trends emerging from evaluation at the field testing stage.

As the present report is concerned with curriculum development processes and procedures, it is formative rather than summative evaluation that is considered in this chapter. However, researchers also have engaged in a number of interesting summative evaluation efforts in relation to ASEP and these have formed the basis for a separate review commissioned by the Curriculum Development Centre (Fraser, 1978).

Although, in hindsight, it is clear that the evaluation efforts associated with field trials of ASEP materials had a primarily formative rather than summative function, this distinction understandably was not fully appreciated at the time by all ASEP staff. When ASEP was first established, the field of curriculum evaluation was still in its infancy both in Australia and internationally. Consequently, it is not suprising that ASEP staff at large (including those involved specifically in evaluation) were neither fully appreciative of the important distinction between formative and summative evaluation nor experienced in the range of evaluation techniques likely to be useful specifically in formative evaluation.

Curriculum vs. Student Evaluation

Not only was ASEP's curriculum evaluation orientation formative rather than summative, but also ASEP's efforts with regard to student evaluation were concentrated on formative evaluation. In fact, quite early in ASEP's lifetime, it was decided that the development of summative tests of student achievement would be the individual school's responsibility entirely. Consequently, ASEP developed no instruments for assessing the student's overall progress. On the other hand, ASEP made a substantial commitment to the formative evaluation of student progress through the development of extensive diagnostic self-administered tests which are contained in the final published versions of ASEP units. These diagnostic tests, which are provided at the end of sections of ASEP units, are self-administered and self-corrected by the student. In fact, a major feature of these diagnostic tests is that the student is provided with explanations for the right answer, reasons why alternative answers are incorrect and suggestions for further reading for students answering a particular question incorrectly. The fact that these tests are self-administered and that answers are provided within ASEP units ensure that they are used for their intended formative purpose and precludes the possibility of teachers using them for summative purposes. Furthermore, as the diagnostic tests contained in the published version of ASEP materials were developed for the purpose of student evaluation, they are not discussed further in this chapter since the focus here is upon curriculum evaluation procedures.

Nevertheless, ASEP did use tests of student achievement as part of their curriculum evaluation efforts, that is, in addition to the self-administered, self-corrected diagnostic tests included as part of ASEP units, the second trials made use of a series of separate achievement tests which were administered by teachers and scored and collated by ASEP staff. However, these tests were not intended to assess the progress of individual students. Rather, the combined performance of large groups of trial students was used as an index of the success of ASEP materials in promoting the achievement of certain aims and for identifying common areas of deficiency or misunderstanding which would need attention when revising materials. In particular, it was hoped that analyses based on the performance of

large groups of students on the individual items comprising those tests would provide some so-called "hard data" about areas in which specific revision would be needed if the materials were to achieve their intended aims

A major insight achieved by the time of the second trials was that there was a need for two separate achievement tests for each unit, one which was a separate test to be administered by the teacher and collated by ASEP staff for curriculum evaluation purposes, and the other which was self-administered by students for the purposes of individual diagnosis This insight, however, had not been reached at the time of the first trials Instead, at that time, a single test was used which attempted to combine student evaluation and curriculum evaluation purposes. The idea was that, first, students would self-administer and self-correct each test for diagnostic purposes and, second, all response sheets would be returned to ASEP for collation for curriculum evaluation purposes. This method of using only a single test was abandoned in favour of the use of separate tests because often different sets of items ideally were needed for student and curriculum evaluation purposes and because ASEP staff were worried about the quality of data obtained from self-tests for which students had ready access to the correct answers

Although Document 73 (ASEP, 1972a) makes it quite clear that the diagnostic tests incorporated into ASEP units should not be seen as part of ASEP's curriculum evaluation procedures, the writing of these diagnostic tests still occupied a very sizable proportion of the evaluation staff's time. Moreover, as these diagnostic tests had to be ready in time for inclusion in the units themselves, their development was subject to the same stringent production deadlines as the units as a whole For this reason, the development of diagnostic tests often assumed priority over other tasks concerned specifically with curriculum evaluation Consequently, when considering the curriculum evaluation initiatives undertaken by ASEP staff, it is important to appreciate that the amount of effort which ASEP's three or four full-time evaluation personnel could expend on curriculum evaluation initiatives was reduced considerably by their higher-priority responsibilities in diagnostic test-writing

Range of Methods in Formative Evaluation

The range of alternative evaluation techniques available for use in formative curriculum evaluation is quite broad (see Grobman, 1968, Conen, 1973b, Baker & Alkin, 1973, Baker, 1974, 1978, Champagne & Klopfer, 1974, Sanders & Cunningham, 1974, Harlen, 1975, Krus et al., 1975, Novick, 1976, Steadman, 1976, Bloom, 1977). It is important to note that ASEP's formative evaluation activities also were very broad in scope and encompassed numerous and varied approaches In later sections of this chapter, an attempt is made to provide concrete illustrations of each of the techniques followed by ASEP and, where feasible, to record some tentative observations about their usefulness.

Although student achievement testing was by no means the only information collected during the trials of ASEP materials, it was one area which absorbed a sizable proportion of the evaluation team's time As the original proposal for the funding of ASEP clearly requested provision for people referred to as "test item writers" rather than "curriculum evaluators" (Ramsey, 1971), ASEP's evaluation were chosen more for their accomplishments as writers of achievement test

items than for their experience in curriculum evaluation Given this background, it was quite predictable that the use of student achievement measures formed one of the key elements in ASEP's formative evaluation procedures

Evaluation vs. Dissemination

ASEP's field trials were intended not only to provide the formative evaluative information necessary to guide the rewriting of materials, but also to facilitate the dissemination of ASEP materials throughout Australia (Ramsey, 1971), that is, through the national trials, a nucleus of science teachers became familiar with ASEP's philosophy, gained experience in its use and felt at least a degree of "ownership since there existed a mechanism through which teachers' views could be fed back to the Project team and acted upon in the rewriting of units. Even in situations where ASEP writers in fact ignored suggestions made by trial teachers, it is likely that teachers' commitment to ASEP was enhanced by knowing that their opinions were being sought Moreover, an empirical study (Owens, 1978) has shown that participation in ASEP's trials promoted dissemination. In particular, Owens found that participation by the head of science in ASEP's trials was a major factor in promoting the later use of ASEP materials in a school.

As well, the first trials created regular contact between teachers and ASEP staff through teachers attending regular meetings at ASEP headquarters and through ASEP staff visiting schools Consequently, a particularly strong liaison was developed between trial teachers and ASEP's writers. For this reason, the first trials also provided a very good vehicle for the dissemination of ASEP materials locally through the training of a nucleus of Victorian teachers in their use (Northfield, 1976).

Organisation of Field Trials

Many ASEP units underwent field testing twice The first versions of ASEP units were subjected to local field trials in schools in Victoria, whereas the second versions underwent trials in a national sample of schools However, there were a number of noteworthy exceptions to this pattern First, as a few units were essentially adaptations of units developed previously overseas (e g., ASEP's **Forces** was based on an ISCS unit produced in the United States), these were subjected only to the second (national) field trials. Second, as time and funds began to run out towards the end of the project, it proved necessary to exclude some units from the national trials Also, for some units which actually underwent national trial, time stringencies towards the end of the project meant that it was impossible to collate and make use of any feedback material when preparing the final version of units.

Although there existed some differences in the evaluation procedures followed in the first and second trials, they were sufficiently similar in many respects to permit them to be discussed together in this chapter. One major contrast between the two trials was that the first trial involved a smaller number of classes (about eight) located in the Melbourne metropolitan area, whereas the second trial involved a larger number of classes (over 20) drawn nationally from all Australian States. An important reason why the first trial was locally based was to enable close contact to be maintained between ASEP staff and trial schools The restriction in the size

and location of the sample for first trial also provided a relatively economical initial tryout of materials. In contrast, the more comprehensive national trial was designed to determine the suitability of units in a wider variety of classrooms, to ascertain the specific needs of the various States and to gather information about sources of equipment and teaching aids for the units in various States.

Whereas teachers were in direct contact with ASEP staff during the local trial, during the national trial the teachers in each State worked with a Trial Coordinator appointed by the State Advisory committee The State Trial Coordinator organised the trial of all units, was given time off from part of his or her professional duties to do this work and coordinated trials on behalf of ASEP and the relevant State Advisory Committee. Also, for the trial of each unit, there was a team leader in each State who was responsible to the Coordinator for both participating in and coordinating the trial of that specific unit Team leaders typically were heads of science departments in their schools, whereas the remainder of each team normally involved approximately three other science teachers who also trialled the unit. In selecting trial schools in each State, it was required that the proportion of students in various types of school systems be reflected in the proportion of teachers in all teams in a given State.

In addition to the trial schools selected and monitored by the Trials Coordinator in Victoria, ASEP staff also selected another few schools in Victoria in reasonable proximity to the ASEP headquarters to trial the second version of each ASEP unit The reason for this was that, in the light of experiences gained during the first trial, it was felt that highly valuable feedback information could be obtained through visits made to local trial classes by ASEP personnel But, as ASEP staff did not wish to interfere in any way with the field testing efforts organised by the Trials Coordinator in Victoria, ASEP established a separate set of schools which agreed to trial a unit and permit ASEP staff to visit trial classes. These trial schools, however, were not involved in providing the types of evaluative information which were collected by the Trials Coordinators in each State.

TYPES OF EVALUATIVE INFORMATION

This section describes and gives concrete examples of the types of formative evaluation information collected by ASEP during the local and national trials of units Also, preliminary consideration is given here to some of the methods used by the ASEP team in the collation of evaluation information By providing these authentic and concrete examples of the evaluation approaches used by ASEP, it is hoped that others involved in the formative evaluation of curricula (whether school-based or project-based) will be provided with practical assistance

Experts' Responses to Structured Questionnaires

The collection and collation of expert opinion was a major approach to the evaluation of the trial versions of ASEP units. For each ASEP unit, the same structured questionnaire was con[illegible]ted by a group of experts consisting of external consultants, teachers whose classes were involved in the classroom tryout of the unit and members of State Advisory Committees (i.e , groups of science [illegible]ators and teachers organised by ASEP in each State to assist the Project) In

particular, the State Advisory Committees paid special attention to any specific difficulties which were likely to arise in using the unit in their own State (e g., because of special syllabus requirements).

In the case of the first trial of the ASEP unit entitled **Charge,** a total of 39 experts provided responses to structured questionnaire items. Part of this group of experts consisted of four external consultants who were known for their special interest either in physics or physics education, these were A Klein (Melbourne University Physics Department, Victoria), Professor Makinson (Macquarie University Physics Department, New South Wales), B. Webber (Salisbury Teachers' College, South Australia) and E. Gardiner (Melbourne Grammar School, Victoria) The second group consisted of the eight teachers of the classes involved in field testing the unit in schools in the metropolitan area of Melbourne. For this particular unit, three of the schools were coeducational government high schools, three were girls' non-Catholic independent schools, one was a Catholic boys' school and one was a non-Catholic independent boys' school The remaining group comprised 27 members of State Advisory Committees (five from South Australia, seven from Queensland, four from Western Australia, five from Victoria, three from Tasmania and three from New South Wales).

These experts were asked to provide their opinions about the 27 different aspects of the unit shown in Table 5 by responding on a five-point scale ranging from "very favourably impressed" to "unsatisfactory". It can be seen from Table 5 that the 27 individual items covered four areas, namely, ASEP philosophy, student materials, teachers' guide and appearance and production. But, as people were allowed to omit a rating for any aspect about which they felt unable to comment, the frequencies of all ratings do not always sum to 39.

As different experts could have different perspectives, clearly the responses of each individual were important. External consultants from university physics departments could have viewed the unit differently from teachers or members of State Advisory Committees. Teachers might have obtained unique insights from field testing materials Also, the ratings provided by State Advisory Committees could vary from State to State to reflect important between-State differences. Nevertheless, although the value of each individual's responses was recognised, the total amount of information available tended to be unwieldy. In fact, the responses of 39 different experts to 27 different questions produced 1,053 different pieces of information.

Also, the time pressures associated with ASEP's production schedule meant that the collation of feedback material and its use in revising units had to be completed within a fairly limited time period Consequently, these time pressures led to some conflict between the need to pay careful attention to the differences in opinion expressed by each of the 39 experts and the need to summarise the cumbersome set of data quickly in a manner which highlighted major trends. These considerations led to the practice of aggregating responses across the whole group of respondents as shown in Table 5. Although the curriculum developers had access to each expert's individual responses when rewriting the unit, a certain amount of time was saved by using summaries like that illustrated in Table 5 to

identify general trends and specific areas for which the responses of individuals needed to be scrutinised more closely.

Experts' Unstructured Comments

In addition to the structured questionnaire described above, each of the 39 experts also was asked to provide unstructured comments which were recorded either as responses to open-ended questionnaire items or which were recorded directly onto a copy of the unit itself. Also, some of these experts provided a covering letter which made additional global statements. In order to provide concrete illustration of the types of information obtained by these methods, Table 6 lists some typical examples of comments made by the same group of 39 experts who were involved in evaluating the first trial version of **Charge.**

TABLE 5: Summary of Experts' Responses to Structured Questionnaire Items about the Unit "Charge"

	Aspect of Unit	Frequency of Rating				
		Very favourably impressed 1	2	3	4	Unsatis-factory 5
1.	**ASEP Philosophy**					
1.1	Reflection of ASEP objectives	17	18	1	-	-
1.2	Reflection of ASEP content themes	20	13	2	1	-
1.3	Adherence to ways of dealing with subject matter according to Piagetian theory	11	13	8	1	-
1.4	Provisions for individual differences	[illegible]	12	9	1	-
1.5	Use of the inquiry approach	16	15	5	-	-
2.	**Student Materials**					
2.1	Authenticity of science content	22	11	5	-	1
2.2	Appropriateness for students' levels of development	11	19	[illegible]	1	-
2.3	Appropriateness for existing classroom conditions and resources	14	16	9	2	2
2.4	Organisation and structure of learning experiences	15	16	6	2	-
2.5	Quality of tests	14	12	10	3	-
2.6	Suitability of students' recorded work	10	15	8	2	2
2.7	The name of the unit	18	8	2	-	-
[illegible]	The length of the unit	7	14	9	3	1

TABLE 5 Continued
Summary of Experts' Responses to Structured Questionnaire Items about the Unit "Charge"

	Aspect of Unit	Frequency of Rating				
		Very favourably impressed 1	2	3	4	Unsatis-factory 5
3.	**Teachers' Guide**					
3 1	Adequacy of information supplied	9	16	10	-	-
3 2	Adequacy of suggestions for classroom organization and procedures	11	12	6	2	1
3 3	Adequacy of lists of equipment required	17	13	4	2	-
3 4	Adequacy of lists of references and audiovisuals	2	6	12	7	-
3 5	Ease of use	10	16	5	3	1
3 6	Layout and organisation	13	20	3	1	2
4.	**Appearance & Production**					
4 1	Style	11	15	10	1	-
4 2	Layout	5	23	7	3	-
4 3	Grammar and Punctuation	5	19	9	1	4
4 4	Typography	8	13	10		1
4 5	Size of booklets	20	8	7	3	-
4 6	Photographs	10	19	5	3	2
4 7	Diagrams and illustrations	12	12	7	3	1
4 8	Cartoons	14	13	4	7	-

Meetings Involving Trial Teachers and ASEP Staff

During the first field testing of each ASEP unit, trial teachers visited ASEP headquarters every two weeks to meet with the writers and other ASEP staff. At these meetings, ASEP staff could ask questions and teachers could report their experiences and problems. Teachers emphasised what students and teachers actually were doing in the classroom and ASEP staff provided guidance about what future parts of the unit would involve. Also some audio and video tapes were made of some lessons as a basis for discussion during these meetings. Although the national trials were not organised in a way which provided the opportunity for meetings between ASEP staff and trial teachers, nevertheless, it was noted previously that ASEP staff supplemented the list of national trial schools with several other local schools which could be visited by ASEP staff.

TABLE 6: Unstructured Comments Made by Experts about the First Trial Version of "Charge"

External Consultants

This unit is brilliant in concept and execution

Fine! The unit is experimentally based, interesting and relates to the environment

The teachers' guide did not measure up.

Much improvement is needed in editing

Teachers

I am afraid I could not justify the time involved in this unit.

The students became bored.

The unit achieves the goals of ASEP.

Although very enthusiastic at first, students lost interest towards the finish

I feel the unit tried to cover too much territory

I think it is an excellent unit and thoroughly enjoyed trialling it. Most of the trial class also enjoyed it and gained a lot from it.

A good unit which measures up well on most points

When preparation time is taken into account, it would be unrealistic to think that it would be feasible to introduce ASEP into the schools unless laboratory assistance was assured.

State Advisory Committees

I tried the experiments myself and feel they would provide students with a good grasp of the concept of charge

In general I thought the students' booklet showed a patronising attitude to the teacher.

The teacher's guide is padded out with fairly useless photographs and diagrams

The unit as a whole is excellent both in content and approach and provides a good set of graded options

The standard of editing is incredibly low

The layout needs improvement

An excellent unit; the best I have seen to date

The format of the teacher's guide is piecemeal

Trial Students' Responses to Structured Questionnaire Items

The evaluation of trial versions of units was based also on student responses to a short structured questionnaire. Table 7 shows six aspects of each unit which were rated by trial students using a five-point scale ranging from "liked very much" to "disliked very much" As there were relatively few items in this part of the questionnaire, it proved feasible to collate results separately for each individual class involved in the first trial As a greater number of schools was involved in the national trials, results tended to be collated separately for the group of classes in each State Table 7 presents data from two of the individual schools (namely, Huntingdale High School and Firbank Church of England Girls' Grammar School) involved in the field testing of the first version of **Charge.** For economy, however, ASEP staff collated information for a random sample of only 15 students from each class instead of using all students The bottom of Table 7 provides aggregated results for a sample of 105 students consisting of 15 students chosen randomly from the seven schools whose feedback had been received at the time of collation

TABLE 7: Summary of Student Responses to Structured Questionnaire Items

School	Aspect of Unit	Frequency of Rating: Liked very much 1	2	3	4	Disliked very much 5
	Subject-matter	2	7	3	1	2
	Experiments	6	7	1	1	-
School A	Tests	-	5	6	1	3
(N15)	Photographs	1	7	6	-	1
	Diagrams and illustrations	4	3	3	2	3
	Reading level	1	6	4	2	2
	Subject-matter	7	6	2	-	-
School B	Experiments	10	4	1	-	-
(N15)	Tests	3	7	2	3	-
	Photographs	7	3	2	1	2
	Diagrams and illustrations	11	1	-	-	3
	Reading level	5	4	4	2	-
Total	Subject-matter	24	49	15	11	4
for all	Experiments	53	33	8	9	2
Schools	Tests	8	38	23	24	11
(N105)	Photographs	29	30	26	13	5
	Diagrams and illustrations	35	33	21	9	9
	Reading level	21	31	30	15	8

Trial Students' Responses to Unstructured Questionnaire Items

In addition to responses to the structured part of the student questionnaire, each student involved in the field testing of ASEP units responded to the unstructured part of the student questionnaire which included various open-ended questions. As this procedure led to the collection of sizable amounts of information, ASEP staff involved in collation of feedback needed to establish some quick and convenient method of summarising this information for use by the curriculum developers during rewriting. Table 8 illustrates how this was done by tabulating the frequency of common answers to each of six open-ended questions. The data in Table 8 are for the same sample of 105 students from seven classes involved in field testing the first version of **Charge.**

TABLE 8: Summary of Frequent Student Answers to Open Ended Questions

Question	Frequency	Answer
What did you **like** most about this unit?	29	Doing electroplating in Option 3
	29	Doing experiments
	15	Students work at their own pace
	12	Reading about Benjamin Franklin in Option 6
	8	Connecting circuits up
	7	You can find things out for yourself
	5	ASEP is informal
What did you **dislike** most about this unit?	16	Writing down results of experiments
	11	Giving verbal reports to the class
	9	Not having enough equipment for the whole class
	7	The fact that the class had already done some of the work earlier
	7	Experiments on plastic strips that wouldn't work
	5	The tests
What did you find the most **difficult?**	24	Nothing
	12	Getting some of the experiments to work
	9	The work on insulators
	6	Reading the booklets
	5	The section on ions
What can you **do** now that you couldn't do before?	52	Electroplating
	23	Make a battery
	14	Recharge a battery
	8	Make a spark
	5	Charge things electrically
	3	Work with electricity safely without being frightened

TABLE 8 Continued
Summary of Frequent Student Answers to Open-Ended Questions

Question	Frequency	Answer
What do you **know** now that you didn't know before?	23	Electroplating
	17	Batteries
	12	History of Benjamin Franklin
	6	To avoid standing near pointed objects when lightning strikes
	5	Like charges repel but unlike charges attract.
	3	The finger is a conductor
In what ways do you **feel** differently from before?	10	I'm not so scared of electricity now.
	5	I am beginning to like science more than I used to
	4	I like to do science experiments at home
	4	The importance of electricity in our lives
	2	I'm sure I don't want to be a science teacher.
	2	If I was the seventeenth son of a soapmaker (like Franklin), I could still be famous.

Trial Students' General Comments

Trial students not only responded to the structured and open-ended questionnaire items discussed in the previous sections, but also were required to write down comments describing their general reactions to a unit as a whole. This information was collated by ASEP staff to produce a list of what were perceived to be the most salient comments made by students from each class involved in the field testing of a unit In the case of the trial of the first version of **Charge,** some examples of the general comments made by students are given in Table 9.

Results of Student Achievement Tests

Earlier in this chapter, a description was given of the use of student achievement tests in the formative evaluation of trial versions of units In particular, it was noted that the use of a single instrument for the purposes of both student and curriculum evaluation during the first trial was superseded in the second trial by a revised method in which separate instruments were used for the two separate purposes. The purposes of student evaluation were served by the inclusion of diagnostic self tests within each unit, whereas the purposes of curriculum evaluation appeared better served by a separate teacher-administered achievement test The use of student achievement data from teacher-administered tests is illustrated below with data collected during the second trial of **Charge.**

TABLE 9: Examples of Students' General Comments

Huntingdale High School
The funnys were unfunny.
The unit was good because it had a lot of practical work
This approach is better than being taught off the blackboard by the teacher
The unit was a waste of time except for the copper plating.
The core was boring.

Footscray High School
I think the options are good ideas but I would rather be learning science from the teacher himself.
Most girls aren t interested in this unit mostly boys like this sort of work
I think in cases where you have to set up a complicated experiment or even simple experiments, more diagrams are needed than were in the booklets
I wish we could do more of this

Springvale High School
I enjoyed the experiments.
It was boring in places
It was confusing in places.

Firbank Church of England Girls' Grammar School
At the beginning I liked the unit because it was an entirely new subject But towards the end, I felt bored
I feel this unit was a good introductory unit to electricity, but I think it should have gone into the unit further and it should have been longer
I would like some clearer explanations about ions

Strathcona Baptist Girls' Grammar
I felt that the unit I did was too long but I enjoyed it.
I found the experiments much too long, especially in the first unit At the end it was terribly boring.
There is too much reading to do

St Johns
In some parts of the book there are parts that are too hard to understand
Some of the pictures are not clear enough

Obtaining useful formative evaluative information from student achievement data is not a simple matter For example, the design of an appropriate and economical achievement test posed the difficulties described in Fraser (1973) Although some of the unit's important aims were affective and psychomotor, the need to use an economical paper-and-pencil instrument meant that it was easier to focus only on the unit's cognitive objectives Furthermore, because ASEP units contain numerous sections of optional student material, it was necessary for a common achievement test to omit items measuring aims covered by optional sections and [illegible]trict attention to objectives which were covered by the compulsory part of the [illegible]r which were covered by several different options

In an attempt to make interpretation of data more meaningful, use was made of a pretest as well as a posttest and of a control group as well as the ASEP group. By administering the same test prior to and after completion of the unit, it was possible to gauge the changes in achievement which occurred during the time of studying **Charge.** The purpose of the control group was to prevent attribution of changes to the curriculum when they might have been attributable to other variables, such as the mere passage of time, current cultural events or familiarity gained from taking the same test twice

Altogether 22 classes, each from a different school, were involved in field testing the second version of **Charge** in the six Australian States Analyses were based, however, only on the 17 schools whose data had been returned in time for collation. Each of these schools provided two classes, one as an experimental class and one as a control class. This method of drawing two classes from the same school made the collection of control data easy to organise and quick and led to reasonable comparability between experimental and control groups. Of the 17 classes in each group, six were from New South Wales, five from Victoria, three from Queensland, two from South Australia and one from Tasmania, one class was at the Year 7 level, seven were at the Year 8 level and nine were at the Year 9 level, and 10 classes were from government high schools, two from government technical schools, three from Catholic schools and two from independent non-Catholic schools Also, in order to economize on testing time, a random sample of 10 students who had completed both the pretest and posttest was selected from each class for analysis. The total sample size was 170 for the experimental group and 170 for the control group.

Table 10 shows how achievement test data were collated (see Fraser, 1973) In particular, because of the need to obtain formative evaluative information to guide the rewriting of materials, students' total scores were not considered to be particularly relevant Instead, student performance on individual items was examined in an attempt to identify specific objectives which were not being achieved well by students so that, in turn, material related to these aspects could be revised during the rewriting phase. The main descriptive information recorded in Table 10 is a statement of the objective measured by each item, together with the frequency of correct response shown separately for the experimental and control groups and for the pretest and posttest.

Despite the fact that pretest and control data are available, the interpretation of the results in Table 10 is still far from simple At minimum, the experimental group should have exhibited a greater pretest-posttest improvement than the control group For example, if statistical significance is taken as a guide, a minimum indication that the curriculum was somewhat effective in promoting a particular aim would be that the experimental group experienced a significant improvement in performance, whereas the control group did not Table 10 shows that this minimal criterion, in fact, was met for six items (namely, Items 1, 4, 5, 6, 7 and 8). On the other hand, this minimal criterion was not met for Items 2, 3, 9 and 10, thus suggesting that the parts of the unit dealing with the objectives measured by these latter items were unsuccessful in promoting achievement of intended aims

TABLE 10: Differences Between Pretest and Posttest in Achievement on Individual Items

Item	Objective	Group	Frequency of Correct Response Pre	Post	Significance Test z
1	To recognize situations in the environment where electric charge arises	ASEP	110	132	3 17**
		Control	110	119	1 32
2	To understand how to earth charged objects in the environment	ASEP	35	32	- 0.48
		Control	22	33	2 12
3	To understand that like charges repel	ASEP	71	108	4 52**
		Control	63	86	3 00**
4	To understand that neutral bodies neither attract nor repel	ASEP	106	134	3 62**
		Control	102	114	1.81
5	To understand that unlike charges attract	ASEP	65	86	2 60**
		Control	59	64	0 63
6	To know how long ago Franklin worked with electricity	ASEP	93	109	2.03*
		Control	95	98	0 40
7	To explain an object's charge in terms of positive and negative charges	ASEP	67	100	4 16**
		Control	70	72	0 32
8	To understand that the sign of an object's charge depends on the material with which it is rubbed	ASEP	114	141	3 64**
		Control	118	115	- 0 41
9	To understand that bodies rubbed together acquire equal and opposite charges	ASEP	30	40	1 48
		Control	34	41	1 07
10	To understand some attributes of a scientific model	ASEP	136	137	1 40
		Control	123	119	- 0 53

*p<.05, **p<0 01

It is arguable whether the degree of change observed for the items with statistically significant results is large enough to suggest that the unit was sufficiently successful in promoting a certain aim and, therefore, needed no revision to further enhance achievement. For example, the data in Table 10 for Item 1 show that, among the ASEP group, the number of students correct increased from 110 to only 132 between pretesting and posttesting. Therefore, the data in Table 10 illustrate that, despite the fact that some ASEP staff were hopeful that "hard data" about student achievement of intended aims might have provided a dependable foundation on which to base the rewriting of materials, the lack of clear criteria for interpreting such data made this ideal difficult to realise It is noteworthy that Harlen (1975) also reported some disappointments with achievement data in the formative evaluation of Science 5/13 in the UK

Visits to Trial Classes by ASEP Staff

Quite apart from the extensive written feedback obtained during formative evaluation from experts and students, substantial and useful evaluative information was obtained from classroom visits In fact, during the field testing of the first trial version of each ASEP unit, numerous visits were made to trial schools by writers and other ASEP staff During these visits, in-depth discussion with students and teachers, examination of written records of students' work and informal observation provided valuable feedback information to complement and supplement that obtained using other methods Close attention was paid to errors, inconsistencies and inadequacies in the materials as revealed by their use in the classroom.

Of course, practical constraints prevented ASEP staff from visiting classrooms comprising the national samples of schools involved in the second trials of ASEP units Moreover, it was considered undesirable for ASEP staff to visit the local Victorian trial schools whose oversighting was the responsibility of the State Trials Coordinator. For these reasons, ASEP staff organised it so that the second version of each ASEP unit also was trialled in several additional schools which were close enough to ASEP headquarters to permit visiting from ASEP staff.

ASEP's evaluation summary for the unit **Mice and Men** (ASEP, 1972b) lists some of the observations made by ASEP staff during the eight visits which were made to classes field testing this unit Examples of some of the observations which suggested areas likely to need attention during rewriting of materials were.

- Many students did not read the whole activity before commencing the practical work.
- The blank pages in the record book confused students
- The black and white photographs on display had been ignored
- Most students jumped sections of early work and moved into activities without properly reading instructions

The frequency at which visits were made to trial classes tended to vary from unit to unit, depending upon time constraints and the value which a particular development team placed on this method of obtaining feedback For example, one Materials Development Officer (D. Fisher, private interview, 1981) visited at least

once every class which was involved in the tryout of one of his units. In contrast, an Area Specialist (L. Howell, private interview, 1972) expressed concern about the way that the number of visits to trial schools was being cut because of time problems, especially towards the end of the first trials. Similarly, the Area Specialist Evaluation (K Moritz, questionnaire, 1972) was concerned that Research Officers especially involved in evaluation generally only had time to visit two out of the eight schools involved in the first trial of each unit

There are two noteworthy features of the use of classroom visits as a method of collecting formative evaluative information. First, observation and interview methods used during these visits were highly unstructured and spontaneous in comparison with much of the information collected through use of structured questionnaires Second, as limited formal recording was done of information gleaned from these visits, there was less need to collate information than there was with other methods Often curriculum developers would revise materials simply on their recollections of their own visits to school, or on the anecdotes and observations informally communicated to them by other ASEP staff who had made visits

COLLATION AND USE OF EVALUATIVE INFORMATION

The collation of feedback information was an important part of formative evaluation procedures Clerical assistants working in conjunction with ASEP's evaluation team were responsible for coordinating the final collation of all evaluation feedback into a form which was likely to be useful to the development team During the national trials, however, part of the within-State collation of feedback was completed by coordinators of State trials before the information was returned to ASEP for overall collation.

Some data reduction was needed if the voluminous amount of information was to be reduced to a form which was manageable and useful when writers were revising their units In particular, as the tables in this chapter illustrate, data from structured questionnaires were aggregated to highlight overall trends This aggregation of student data usually was carried out across the total sample, although some national trial data were collated separately for each State However, in contrast to the way that individual responses to structured questionnaires items were aggregated, all open-ended comments made by experts (external consultants, trial teachers, State Advisory Committees) were included in the collation of information. That is, it was thought that the person responsible for rewriting a particular unit should take cognisance of all comments made instead of a somewhat arbitrary subset of comments chosen by the staff involved in the collation task

The size of the summaries of evaluative information for each ASEP unit tended to be quite substantial For example, the inclusion of questionnaire data aggregated nationally or within each State, together with a complete listing of all open-ended comments made by experts, resulted in an evaluation summary of 29 single-spaced pages for the ASEP unit **Pushes and Pulls** and of 18 pages for **Life in Freshwater.**

A notable feature of the evaluation summaries produced by ASEP staff for each unit was their inclusion of a comprehensive set of specific recommendations to be implemented when rewriting units. For example, the evaluation summary for the unit Pushes and Pulls (ASEP, 1972c) included recommendations that:

- The name of the unit be changed to "Forces".
- The amount of reading in the unit be reduced
- Summaries be included at the end of activities.
- The calibration of the student force-measurer against a standard scale be deleted as an activity.
- The photographs on pages 53 and 54 be interchanged
- More space for student responses be allowed in the record book
- The force-measurer be redisigned with a larger base to increase its stablility.

An important question involves the extent to which the recommendations made in evaluation summaries were acted upon in the actual rewriting of materials. Cohen (1973b) has provided an informative table for the ASEP unit **Mice and Men** showing what action, if any, was taken to accommodate feedback information (see Table 11) In fact, Table 11 provides some good illustrations of ways in which information about specific weaknesses identified in materials through use of evaluation procedures influenced the rewriting of a unit This table also shows that, for a variety of reasons, no action at all was taken during rewriting to cater for some of the evaluative comments made

EFFECTIVENESS OF ASEP'S FORMATIVE EVALUATION PROCEDURES

It is difficult to comment either on the overall impact of ASEP's program of formative evaluation activities or on the relative utility of the various sources of evaluative information One impression gained from interviewing different writers within ASEP was that different people found different sources of evaluation feedback differentially useful. Whereas some placed greatest weight on numerical information based upon consensus of the opinions obtained from large numbers of students or teachers, other ASEP writers preferred more intuitive judgements gleaned from casual observation in trial classes or informal talking with teachers and students Similarly, writers differed when rewriting materials in terms of the amount of weight they placed on information obtained from outside consultants, teachers, students and State Advisory Committees.

As ASEP's primary responsibility was the production of units within a fixed time frame, the time at which formative evaluative information became available was crucial Clearly, formative information could not guide rewriting unless it was available well before writing deadlines In fact, these time stringencies led to the situation in which collation of information often had to be done before feedback had arrived from some trial schools and, in some instances towards the end of the Project, final rewriting was done without the benefit of any feedback information. Also, deadlines for revising units sometimes meant that the development team did not have sufficient time to utilize fully all the feedback information which was at its disposal This experience highlighted the potential conflict that can arise between

the need to satisfy production deadlines and to improve the educational merit of curriculum materials through making full use of all the formative evaluative information available.

Another problem which confronted curriculum writers was that feedback from different sources sometimes was inconsistent. For example, a unit might have appeared to be extremely well received in one State but not in another. Teachers could have been unhappy with a particular feature of a unit that was very popular with students. Also quite different reports were sometimes received from the teachers and students at different trial schools.

TABLE 11: Nature of Revisions Made to "Mice and Men" to Accommodate Evaluation Information

Comments and/or Recommendations	Sources of Comments	Actions Taken During Revision
1. **Presentation**		
Too many loose bits. Booklets too thin	SAC*, Teachers, outside consultants	Seven booklets and 14 work-sheets reduced to four booklets
Poor reproduction of photographs	SAC, trial teachers, outside consultants	Slight improvement to a more uniform standard
Presentation cramped, lacking variety - headings barely distinguishable	Outside consultant	More spread out, more variety Headings and sections more distinguishable
Comic mouse overdone	Outside consultant	Less use of cartoons in national trial
2 **Organisation**		
Needs to have statements of relationships of this unit to other units	SAC	Links added in Teacher's Guide
3. **Assistance to Schools**		
Use asterisks to identify most useful reference books	SAC	No action taken
Add prices of reference books	SAC	Added to student reference books
4. **Assistance to Teachers**		
le a breeding timetable ce	SAC	Added in Teacher's Guide

TABLE 11 Continued
Nature of Revisions Made to "Mice and Men" to Accommodate Evaluation Information

Comments and/or Recommendations	Sources of Comments	Actions Taken During Revision
5. **Learning Experiences**		
Add a flow-chart to give students a clear overview of the whole unit	SAC	No action taken
A visit to the zoo or a display of live or preserved mammals or film would make a better introduction	Outside consultant	No reference made to this suggestion
A set of large black-and-white photographs or colour slides could replace Booklet 1 (Mammals)	Trial teachers	No action taken
Use of Australian animals preferred	Outside consultant	Included kangaroo There was already echidna, koala, platypus. These were in the context of their natural habitat
Contrasting comments - Booklets disliked in general (doesn't get any message across). Photographs aroused considerable interest among Year 7-10 students	SAC	Revised version of **Mice and Men** sought to reconcile these comments
6. **Evaluation**		
Test is not challenging enough for the brighter students	Trial teachers	Some questions in national trials had higher levels of difficulty
Include sample items for tests	Outside consultant	Helpful suggestions for evaluating objectives included in Teacher's Guide

* SAC is an abbreviation for State Advisory Committee
Taken from Cohen (1973b)

The direct usefulness of formative evaluation feedback when rewriting units often appeared to be related to its **specificity.** The big advantage in highly specific information was that it was clear to writers exactly where changes were needed within a unit On the other hand, information about experts' views about some general characteristic of the materials (e g , the overall organization of the unit) or data on student achievement of broad goals (e g , comprehension of the concept of electric charge) did not pinpoint e. ctly what changes were needed to rectify a

weakness For example, Fisher (personal interview, 1981) noted that feedback comments such as "I didn't like this section" were not uncommon and did little to guide the rewriting of a unit. ASEP writers often felt that evaluation efforts had identified important weaknesses that should be overcome, but had not provided information about what changes would be needed to surmount the problems.

This simple point about specificity has important implications for the planning of future formative evaluations Whenever evaluation resources for any evaluation are likely to be limited, it could be preferable to concentrate efforts on the collection of specific information which yields clear implications for rewriting, rather than attempting to pinpoint more general problems whose solutions are far from obvious to writers attempting to revise materials It is possible, also, that differences in specificity might explain why several writers at ASEP found comments written directly onto inspection copies of units much more useful in guiding rewriting than the aggregated results from general questionnaires or tests of student achievement of fairly broad objectives.

Based on her experiences in the formative evaluation of Science 5/13 in the UK, Harlen (1975) concluded that the results of children's achievement tests were of much less help in guiding the rewriting of materials than was information obtained from teacher questionnaires and classroom observation In the case of the formative evaluation of ASEP, the specificity of items included in achievement tests often appeared to be a major determinant of their usefulness That is, items testing specific achievement objectives tended to yield some information which was useful in guiding unit rewriting, whereas items assessing general achievement objectives usually failed to produce suggestions specific enough to guide the revision of materials.

In an attempt to obtain the specific feedback which would be useful when rewriting units, ASEP's later evaluation procedures involved asking trial teachers and State Advisory Committees the following direct question. "If you were given the job of revising the unit, what changes would you make?" This question proved very successful because it elicited information directly relevant to the rewriting task at hand instead of general comments about strengths and weaknesses Consequently, one simple but potentially useful inclusion in other future formative evaluations is a question which directly requests suggestions about desirable revisions.

The question of the effectiveness of different methods of formative evaluation cannot be divorced from questions of cost-effectiveness That is, others involved in designing formative evaluation procedures are likely to be interested in finding out, not only what methods used by ASEP might have been more useful than others, but also which methods were very expensive and time-consuming and which were not For example, in the case of ASEP, the use of student achievement testing proved sufficiently costly and time-consuming (especially in terms of test development and data collation time) that this approach to evaluation was abandoned some time before all units had undergone a second trial Although the collation of student questionnaire data also was time-consuming, considerable economy was achieved by restricting attention to a sample of only 10 or 15 students from each [illegible]. In contrast, the method of asking various experts to provide their reactions by

writing on the unit itself provided a relatively inexpensive method for obtaining valuable information which could be used directly without collation when writers were revising materials. Similarly, through visits to trial classes, developers were able economically to gain first-hand insights which could be translated directly into action during the rewriting stage without the need for other staff to be involved in collecting and collating information.

SUMMARY

This chapter, together with the previous one, examines the 38 Steps involved in the development of an ASEP unit The present chapter focused upon those steps involving the collection and collation of formative evaluation information during the field trials of first and second versions of ASEP materials. The main purpose in portraying the formative evaluation procedures followed by ASEP is to provide guidance to others embarking on future formative evaluation endeavours related to curriculum developments, whether project-based or school-based.

The types of evaluative information described in this chapter include experts' responses to structured questionnaire items, experts' unstructured comments, information gleaned from meetings involving trial teachers and ASEP staff, trial students' responses to structured and unstructured questionnaire items, students' general comments, results of student achievement tests and observations made by ASEP staff visiting trial classes. A major orientation throughout the chapter is the provision of concrete illustrations of how these types of data were collected and collated. In the following concluding chapter, some attention is devoted to an attempt to draw out some of the implications from ASEP's evaluation efforts for others attempting future formative evaluation initiatives.

CHAPTER 6

SUMMARY, IMPLICATIONS AND GUIDELINES FOR FUTURE CURRICULUM ACTIVITIES

The purpose of this book is to describe the **processes** which were used in the development and evaluation of the Australian Science Education Project, with a view to identifying practices which appeared to provide promise for future curriculum initiatives Descriptions and evaluations of the ASEP materials (i.e., products) have been undertaken elsewhere (e g., ASEP, 1974, Fraser, 1978, Owen, 1978).

It is important to emphasise here that a generally included set of curriculum processes, that of implementation, was **not** included in this present publication. This was because ASEP, at the peril of its founding parents (the Commonwealth Government), made no provision for implementat i The provision of funding to support strategies to promote implementation, including inservice education for teachers, was specifically denied by the Commonwealth funding agencies (and left up to each State to organise and fund). In hindsight, this has proved a major impediment both to the widespread adoption of ASEP materials and to the more effective use of the materials to reshape classroom practices in a manner envisaged by the ASEP developers.

Nevertheless, ASEP was a most significant national curriculum project in the Australian context It pioneered large-scale State-Commonwealth cooperation in education and represented also a first cooperative venture in curriculum between the six diverse State systems of education In so doing, ASEP drew upon some of the lessons of curriculum experiences in the UK and USA from the 1960s in order to translate and supplement these in the Australian context. When ASEP was initiated in the 1960s, the ink had not yet dried in some Australian States from curriculum decrees which virtually required the schools to accept autonomy for school-based decision-making Meanwhile, other States still adhered fairly strongly to centralised curriculum policies Differences in State practices were exacerbated by rivalries and jealousies between some State Departments of Education These had severely restricted the possibilities of interstate cooperative ventures in the past.

In this concluding chapter, a summary of some of the salient issues from the study is given and some of the implications for future curriculum work are drawn.

ASEP AS PIONEER OF INTERSTATE CURRICULUM COOPERATION

It was quite a political accomplishment for ASEP to be successful in involving and accommodating such a diverse range of State educational philosophies and practices within a single national curriculum project, especially since ASEP was initially perceived as being an outgrowth of its **Victorian**-mounted and **Melbourne**-based precursor, the Junior Secondary Science Project (JSSP) Of course, once the required three States had agreed to participate, other States became reluctant to be seen as not participating This was specially true as politically it meant that a State would be declining to accept "free' Commonwealth funding.

Thus, an important by-product of ASEP was the initiation of interstate cooperation In fact, some people attribute to ASEP the origins in the mid-1970s of the Curriculum Development Centre (CDC). They perceive the CDC as emanating from the successful cooperation between States within the ASEP experience In fact, a national curriculum centre had been foreshadowed in some of the early ASEP documents, but it was seen then as a rather speculative and radical concept. ASEP successfully illustrated its ability to walk along educational tightropes tensioned by interstate educational jealousies between State systems and other factional interests The strategies were remarkable in terms of their political diplomacy.' For example, ASEP involved a range of people in both the planning and writing stages of the Project. The politics of interstatism were first signalled in the ASEP Guidelines Conference. At that conference, many of those who attended had expertise in education or the sciences to offer, but fewer had experience in curriculum activities. Several participants were involved to help mould favourable attitudes in all States towards the concept of a national project.

ASEP developed into an educationally and politically important project. Hence, it became important to document its curriculum processes and to draw some implications for future curriculum activities, whether they might be centrally controlled or school-based. Several sets of issues arose from the study of the ASEP processes and these are reviewed below.

SOME ISSUES ASSOCIATED WITH DEVELOPMENT OF ASEP

The Objectives Issues

Some issues concerning objectives were discussed in Chapter 2, these are now reviewed here and some implications are drawn There was a preoccupation with the elaboration of statements of sets of objectives in the early stages of ASEP To the extent that these processes involved ASEP staff in discussion and writing, this was no doubt a useful activity for focusing subsequent writing within the Project framework. However, recent research concerning statements of objectives indicates that:

(1) Classroom teachers in general do not find statements of objectives the most helpful beginning for them in planning or implementing their curricula,

(2) Involvement of teachers in decision-making at the developmental stages of curriculum increases commitment to implementation of the decisions made. In other words, pre-determined objectives imposed by edict from outsiders are less likely to be **implemented** effectively than objectives determined by teachers as the implementers.

The resultant statements of ASEP objectives offered hopes for supplementation if not replacement of solely didactic science classrooms. These objectives expressed emphases upon:

- individual differences between students,
- flexibility of content and sequence;
- the provision of widespread experiential learning in science, and
- allowances for student involvement in decisions about their learning.

Perhaps these objectives raised hopes which represented the triumph of hope over experience! The possibility of materials alone having such widespread effects without the provision of extensive concurrent teacher re-education programs remained doubtful.

The preoccupation with and commitment of resources to the elaboration of written statements of aims reflected the impact in Australia in the 1960s of the **Taxonomy of Educational Objectives** (Bloom et al., 1956) and the strength of the "behavioural objectives movement". It had become fashionable in the 1960s to emphasise the prespecification of educational objectives. Not only had the **Taxonomy of Educational Objectives** emerged, but also the "Measurement in Education" course at the University of Melbourne was heavily based on the **Taxonomy** and Popham's "Instructional Objectives Exchange" (IOX) based at UCLA was at its peak. The IOX sold many thousands of sets of printed behavioural objectives by subjects and year levels (e.g., science teaching objectives for junior secondary years).

The enshrinement accorded to objectives in the 1960s belied their actual influence on classroom teachers and practices. This is well illustrated by ASEP for, if statements of objectives had been followed by teachers, the resultant ASEP classrooms would have been fairly similar one to the other. However, the wide variations in practices of ASEP teachers (evidenced in postgraduate research emanating from Monash University) provide testimony for the fact that teachers either were unaware of, or chose to ignore, statements of objectives.

Another factor which at the time of ASEP misguidedly reinforced the impact of statements of science teaching objectives resulted from a misreading of the Tyler "rational model" approach to curriculum. This set of misperceptions fuelled the false view that the development of statements of objectives was a prerequisite to curriculum development. In fact, this was specifically disclaimed by Tyler (see Tyler, 1950, and personal discussions). This has also been exposed as mythical by the findings from classroom research. These findings have indicated consistently that teachers rarely find prespecification of educational objectives helpful either for their lesson preparation or for the classroom interpretation of curricula.

The Roles of Curriculum Materials

Regardless of the "objectives" issues, implicit in the "project approach" to curriculum change is the belief that curriculum materials could have significant impacts upon classroom practices. It was this belief that led educators in the USA and the UK and Australia to engage centralised teams of people with particular sets of expertise in concentrated attacks upon the production of materials intended to reshape science classrooms.

There were attempts to gear the units comprising the ASEP materials to three Piagetian stages In retrospect, this seems to have been a half-hearted effort, for which there was indifference and lack of commitment on the part of many of the unit developers Through administrative edict, the stages seem to have had some influence on the sequencing of the units (at least, into three categories) but little effect upon the content or format of the units. The classroom flexibility of ASEP usage was enhanced, in fact, by the absence of consensus about the existence of any internal logic or sequence of the subject matter included in the units. The unquestioned acceptance of Piaget stages too often has created barriers to challenging the creative minds of young children. In his recent criticism of the application of Piaget's stages, Boomer (1986, p 12) stated that

> *A view is emerging of the brain as being capable of extraordinary feats of connection and pattern finding from the moment it turns itself upon the world.*

There were also grandiose plans for the ASEP materials to refashion science classrooms The intentions were to update content and supplement (if not supplant) traditional science teaching strategies of didacticism (chalk-and-talk, teacher domination) through the use by students of research including experimental ("hands-on") science experiences In addition, these experiences were designed to allow in a number of ways for individual differences The differences catered for were variations in learning rates, often in terms of greater difficulty levels for students completing the basic activities and seeking additional options and activities, and variations in learning sequence However, the planning of the ASEP materials often denied the slower students the opportunity of working on options which in many cases had greater interest levels than the basic activities

Procedures of Curriculum Materials Development

Arising from discussion within the staff groups at ASEP headquarters about curriculum procedures, an attempt was made to reduce ASEP unit development to a series of 38 steps. In Chapter 4, the 38 steps which evolved as an ASEP model are described and critically reviewed This model, it was said, would lead to more efficient use of resources and also result in more effective materials.

Based on an analysis of the 38 steps involved in the development of ASEP units (see Chapter 4), the following tentative implications emerged to guide future curriculum development work:

(1) The procedure of developing and vetting detailed specifications of curriculum units prior to commencing writing is likely to lead to more economical use of resources.

(2) Procedures of reflective evaluation, involving a group of people discussing proposals for units in advance of their development and then vetting draft versions of units, is likely to lead to more economical use of resources by providing a basis for abandoning or improving units early in their lifetime.

(3) The use of a development team approach, which involves two or more people continuously advising and interacting with a writer, could lead to the development of materials of higher quality than those produced by a writer working alone.

(4) In complex development ventures, it is important to strike an appropriate balance in which deadlines are rigid enough to ensure reasonably efficient use of resources yet still do not lead to a situation in which educational quality is seriously compromised

Evaluation Strategies

In Chapter 5, the various formative evaluation strategies adopted for ASEP were described. Valuable insights about evaluation were gathered from the ASEP experiences The following eight points emerged as useful tentative generalisations to assist others attempting to use formative evaluation to improve curriculum materials:

(1) Different audiences found various sources of evaluative information differentially useful Therefore, it appears desirable for available curriculum evaluation resources to be used to generate a variety of evaluative information.

(2) The usefulness of formative evaluation feedback to the developers of the ASEP units appeared to be related to the **specificity** of the feedback It is suggested that future formative evaluations should concentrate efforts on collecting specific information to yield clear guidance in rewriting, rather than to attempt to pinpoint more general problems whose solutions are unclear to unit writers.

(3) Certain traditional methods of collecting evaluative information (e.g , student achievement testing) are likely to be more costly and less effective in influencing writers than others (e g , visiting trial classrooms or having experts write comments onto copies of materials) In particular, visits to trial classes by writers involve economies since they provide direct visible feedback and they require little recording and collation of information.

(4) The use of diagnostic tests to identify student problems, and completely separate teacher-administered achievement tests for curriculum evaluation purpose, are likely to represent a more valid and useful set of strategies than attempting to use the same tests to cover both purposes.

(5) Data on student achievement on individual test items are likely to be more useful in guiding the revision of materials than results based on total test scores.

(6) The use of both structured **and** unstructured questionnaire items seeking feedback on curriculum units is likely to produce information which is more useful than that obtained by either approach alone.

(7) Because formative evaluations can generate large amounts of information, unit writers are likely to find collated feedback results (e g , frequencies of common responses to open-ended questions) more useful than raw data when rewriting materials.

(8) A balance is necessary between the need to satisfy production deadlines, on the one hand and the improvement of the educational quality of curriculum materials through making full use of all available formative evaluative information, on the other.

Finally, in terms of their comparability to accepted overseas standards for the evaluation of curriculum projects, how well do ASEP processes shape up? Consider a meeting of a group of 73 consultants convened in 1975 by the National Science Foundation in the USA to evaluate 19 secondary-level curriculum development projects. The 10 evaluative criteria which were employed included accuracy, appropriateness, implementation, cost and educational soundness (National Science Foundation, 1976) How far did the processes employed by ASEP provide inbuilt checks upon these criteria? The following points seem to answer this question

(1) In relation to accuracy and appropriateness, ASEP referred its units to the scrutiny of both educators and scientists as screening devices

(2) Funding provisions for ASEP specifically did not allow for implementation

(3) Costs were contained within stringent Commonwealth grants

(4) Educational soundness of ASEP materials was evaluated via classroom trials and other evaluation procedures

SUMMARY

This concluding chapter has drawn out some of the lessons learned from examination of the curriculum development and evaluation processes engaged in during the lifetime of the Australian Science Education Project (ASEP) For example, ASEP's development team approach and use of procedures for vetting preliminary specifications and versions of curriculum materials have implications for ways of developing better-quality and more cost-efficient curriculum materials in the future. Similarly, many of the formative evaluation techniques used by ASEP (e g , use of structured and unstructured methods together, visits to trial classes, collating cumbersome feedback information) provide valuable guidance about how to improve curriculum materials through the judicious use of formative evaluation methods.

Certainly ASEP processes resulted in a set of products (curriculum materials) which were highly cost-efficient compared with other curriculum project materials and which appear to have had a significant effect on the quality of science education in Australia. By providing a retrospective account of the curriculum development and evaluation processes employed by a pioneering curriculum

venture, this book is intended to contribute to curriculum improvement through its concrete illustration of useful curriculum development and formative evaluation techniques used by ASEP. While the material discussed has obvious implications for educators involved in other large-scale curriculum development projects, it is also relevant to teachers whose local, school-based curriculum development and adaptation efforts are likely to benefit from the use of some of ASEP's development and evaluation processes.

REFERENCES

ANDERSON, S B & BALL, S (1978). **The Profession and Practice of Program Evaluation.** San Francisco: Jossey-Bass.

ASEP (1970) **Report of the Guidelines Conference.** Melbourne ASEP

ASEP (1972a) Document 73 Some thoughts of the evaluation section about tests for units Unpublished paper, Australian Science Education Project

ASEP (1972b) Unit evaluation summary for national trial of **Mice and Men.** Unpublished paper, Australian Science Education Project

ASEP (1972c) Unit evaluation summary for national trial of **Pushes and Pulls.** Unpublished paper, Australian Science Education Project

ASEP (1974) **A Guide to ASEP.** Melbourne Government Printer

BAKER, E L (1974) Formative evaluation of instruction In W J Popham (Ed), **Evaluation in Education: Current Applications.** Berkeley, Calif McCutchan

BAKER, E L (1978) Evaluation dimensions for program development and improvement In S B Anderson and C D Coles (Ed), **Exploring Purposes and Dimensions.** New Directions for Program Evaluation, No 1, San Francisco Jossey-Bass

BAKER, E L & ALKIN, M C (1973) Formative evaluation of instructional development **AV Communication Review, 21,** 389-418

BLOOM, B S (1977) Tryout and revision of educational materials and methods In A. Lewy (Ed.), **Handbook of Curriculum Evaluation.** Paris Unesco

BLOOM, B S ET AL (1956) **Taxonomy of Educational Objectives: Handbook I - The Cognitive Domain.** New York David McKay

BOOMER, G (1986) The early generation of brain power Unpublished address at the Conference on the First Years of School, Sydney, May

CHAMPAGNE, A & KLOPFER, L E (1974) Formative evaluation in science curriculum development **Journal of Research in Science Teaching, 11,** 185-203

COHEN, D (1972). Curriculum development in the sciences **Australian Science Teachers Journal, 17,** 3, 7-14

COHEN, D (1973a) New approaches to the process of developing and evaluating chemistry curricula Paper presented at International Congress on Improvement of Chemistry Education, Wroclaw, Poland, September

COHEN, D (1973b) Evaluation of integrated science curricula In P Richmond (Ed), **New Trends in Integrated Science Teaching, Volume 2.** Paris UNESCO

COHEN, D (1974) Some considerations in the development, implementation and evaluation of curricula Technical monograph No. 2, Science Education Center, University of Iowa

COHEN, D (1977) Primary school science in the Northern Territory A report commissioned by the Director of Education, Australian Department of Education Unpublished report, Macquarie University.

COHEN, D. (1985) Curriculum decision making School based. Entry in T. Husen and N. Postlethwaite (Editors in Chief), **International Encyclopedia of Educational Research and Studies,** Volume 2. Oxford: Pergamon.

CRONBACH, L J , AMBRON, S , DORNBUSCH, S M , HESS, R D , HORNICK, R.C., PHILLIPS, D C , WALKER, D F & WEINER, S.P (1980) **Toward Reform of Program Evaluation: Aims, Methods, and Institutional Arrangements.** San Francisco: Jossey-Bass

CURRICULUM DEVELOPMENT CENTRE (1977) **Triennial Program 1977-1979.** Canberra: Curriculum Development Centre.

FRASER, B J (1973). Curriculum evaluation Part II An illustration using ASEP trial data. **Australian Science Teachers Journal, 19,** 2, 42-53

FRASER, B J (1978) **Review of Research on Australian Science Education Project.** Canberra Curriculum Development Centre

FRASER, B J & EDWARDS, J F (1982) **Guide to Evaluation of School-Based Projects.** Sydney: Northern Districts Education Centre

GROBMAN, H (1968) **Evaluation Activities of Curriculum Projects.** AERA Monograph Series on Curriculum Evaluation, No 2, Chicago Rand McNally

HALL, G & LOUCKS, S (1977). A developmental model for determining whether the treatment is actually implemented **American Educational Research Journal, 14,** 263-276.

HARLEN, W (1975) A critical look at the classical strategy applied to formative curriculum evaluation **Studies in Educational Evaluation, 1,** 37-53

KRUS, P H., TAYLOR, A M , THURLOW, M.L , TURNURE, J.E & HOWE, R. (1975) A formative evaluation design for assessing instructional materials **Studies in Educational Evaluation, 1,** 131-137

LOCKARD, J D. (1975) A report on the exploratory conference on the National Science Foundation's impact on U S science curriculum development Unpublished document, University of Maryland.

NATIONAL SCIENCE FOUNDATION (1976) **Panel Evaluation of 19 Pre-College Curriculum Development Projects.** (ERIC ED 125160)

NORTHFIELD, J R (1976) Reflections on ASEP **Australian Science Teachers Journal, 22,** 3, 5-14

NOVICK, S (1976) The use of formative evaluation procedures for improvement of a socially-oriented course in chemistry **Studies in Educational Evaluation, 2,** 1-7

NSW DEPARTMENT OF EDUCATION (1985) **Handbook: Instructions and Information for the Guidance of Teachers, Book I** (3rd edition) Sydney. Department of Education.

OWEN, J M (1978). **The Impact of the Australian Science Education Project on Schools.** Canberra. Curriculum Development Centre.

POPHAM, W J (1969) Curriculum materials **Review of Educational Research, 39,** 319-338.

RAMSEY, G A (1971) Formative evaluation and the Australian Science Education Project **Research 1971,** 99-108

RAMSEY, G A (1972) Curriculum development in secondary school science **Quarterly Review of Australian Education, 5,** 1 & 2 (whole issues)

RAMSEY, G A. (1974) Some reflections on the Australian Science Education Project Unpublished amended transcript of informal discussions between Gregor Ramsey, John Edwards and Joe Dasbach at the Regional Centre for Education in Science and Mathematics in Malaysia.

ROSENSHINE, B (1970) Evaluation of classroom instruction **Review of Educational Research, 40,** 279-300.

SANDERS, J.R & CUNNINGHAM, D J (1974) **Techniques and procedures for formative evaluation.** Research, Evaluation, Development Paper Series, Northwest Regional Educational Laboratory, Portland.

STEADMAN, S (1976) Techniques of evaluation In D Tawney (Ed), **Curriculum Evaluation Today: Trends and Implications.** Schools Council Research Studies, London. Macmillan.

TABA, H (1962) **Curriculum Development: Theory and Practice.** New York Harcourt, Brace and World

TYLER, R W (1950) **Basic Principles of Curriculum and Instruction.** Chicago University of Chicago Press.

WELCH, W W (1969) Curriculum evaluation **Review of Educational Research, 39,** 429-443.

APPENDIX A

EXTRACTS FROM SELECTED ASEP POSITION DOCUMENTS

DOCUMENT 35 - AIMS OF ASEP

The Project's major aims were to develop in children:

1. **Some understanding of man, his physical and biological environment and his inter-personal relationships**
   Abstract scientific concepts are less pertinent to children at junior secondary level than some of the more practical aspects of science Knowledge of most relevance to the children is to be favoured.

2. **Skills and attitudes important for scientific investigation**
   Such skills include observing, classifying, detecting relationships, formulating problems, obtaining information, interpreting findings and communicating effectively. Relevant attitudes include those which pre-dispose an individual to demand evidence in support of claims, postpone judgement when evidence is inconclusive, seek rational explanations, prefer quantification, change opinions in the light of incompatible data, be persistent, be cooperative, be critically tolerant of others' opinions, represent observations honestly, admit to error and take responsibility for actions.

3. **Some understanding of the nature, scope and limitations of science**
   It is hoped to develop some understanding of the principle of proposing and testing an hypothesis, and to have children realise that the laws and conceptual schemes of science change as scientific understanding changes, that science advances through the use of the processes of inquiry, that conventions which aid communication among scientists are standardized by international agreement, that scientists have varied allegiances and personalities, and that not all subjects are open to scientific investigation.

4. **Some understanding of, and concern for, the consequences of science and technology**
   It is hoped to develop some understanding of the way in which the findings of science have led to many technological advances which have contributed enormously to human welfare and civilization, but also a concern that, as a consequence of its impact on the environment, technology has given rise to problems concerning waste, the size of the human population and general ecological change.

DOCUMENT 36 — MAIN IDEAS TO BE DEVELOPED IN ASEP MATERIALS

The main sources of ideas for inclusion in ASEP materials were:

1. **Environmental Scheme**
   This is a list of important ideas concerned with man and his relationship with the environment. There are five main areas comprising the scheme:

   - The ways in which man, the individual, resembles and differs from other individual organisms.
   - How interactions among groups affect decisions made by man.
   - The ways in which man has extended his ability to explore and manipulate his environment.
   - The ways in which technology has changed man's environment
   - The changes in the environment which take place naturally and how man has interfered with these changes

2. **Content of Science**
   This source of ideas is seen as consisting of six themes, representing major concepts of science:

   - The matter of the universe can be organized into units
   - Units can be organized into hierarchies.
   - The behaviour of units can be described and predicted
   - Motion is an essential part of most phenomena.
   - Units interact within the dimensions of time and space
   - Interactions between units tend towards a state of equilibrium.

3. **Nature of Science**
   This source of ideas concerns the following aspects of the nature of science as revealed by its history:

   - Scientific knowledge consists of patterns (laws, generalisations, conventions, etc) created by scientists out of the phenomena of the universe.
   - The patterns, which change as scientific understanding changes, might be the result of planned investigation or conceived through insight.

- One of the main methods of creating patterns is the use of experimental inquiry to look for constancy for events that repeat. However, the procedures of inquiry used by scientists follow no one clearly defined path.

- Advances in science can take place by the interaction of theory and technology.

- Modern scientific research, which currently involves more people than ever before, is costly and requires team work.

DOCUMENT 39 — CHOICE OF TOPICS FOR CLASSROOM STUDY

Topics for ASEP units and the ideas in them were judged against the following eight criteria:

1 The ideas included lead to generalizations which enable children to see relationships that they might not otherwise have seen.

2. The ideas are meaningful to children in that they are related to direct experiences.

3. The ideas are potentially interesting to children.

4. The activities of students contribute to the development of skills and abilities considered desirable.

5 Precedence is given to topics in which ideas considered to be more useful or important are developed.

6. The ideas included are generally able to be dealt with through student activity, preferably handling of apparatus and specimens, observation, use of references, photographs, maps, etc , and instructional devices such as audiovisuals, programs and teaching machines.

7 Simple, readily available equipment and experimental situations are used where possible.

8 The ideas, activities and procedures involved are feasible. Here consideration is given to the abilities of children and teachers as we know them and the likely situation in schools in the immediate future in respect of equipment, finance and class organisation.

DOCUMENT 3 — WAYS OF DEALING WITH SUBJECT MATTER ACCORDING TO STAGES OF DEVELOPMENT OF CHILDREN

ASEP materials were developed to suit children at the following three stages of development:

ASEP Stage 1 approximates to Piaget's concrete stage,

ASEP Stage 2 represents the transition between concrete and fully developed formal thinking and approximates to Piaget's first sub-stage of formal thinking;

ASEP Stage 3 approximates to Piaget's formal stage

Also the following general principles were derived from Piaget's theory of mental development:

1. New ideas and knowledge should be presented at the level of the child's prese thinking and language.
2. A major source of learning is the activity of the child.
3. Classroom materials should be tailored to the needs of individuals and should present moderately novel situations.
4. Children should be given considerable control over their own learning.

DOCUMENT 38 — USE OF INQUIRY APPROACH

ASEP's use of the inquiry approach was based on the following propositions

1. ASEP has resolved to produce materials aimed at encouraging inquiry.
2. To use an inquiry approach is to apply the processes of science
3. The inquiry approach requires the student to be actively involved in learning
4. In material aimed at developing processes, skills or attitudes, the inquiry approach should be used widely.
5. For students to be able to think and be creative, they should be given opportunities requiring thinking and creativeness.
6. Materials should be produced to show some historical aspects of science