APPLIED SCIENCE IN THE CURRICULUM :

THE CASE OF INDUSTRIAL SCIENCE 12 IN BRITISH COLUMBIA

By

WILLIAM COLIN MACKENZIE

B.A., Mount Allison University, 1973
B.Ed., University of New Brunswick, 1979

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

EDUCATION - CURRICULUM AND INSTRUCTION

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

January 1989

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Department of Education - Curriculum and Instruction

The University of British Columbia
Vancouver, Canada

Date December 28, 1988

ABSTRACT

This study investigates the disjunction between macro-level policy decisions concerning the curriculum and the lived experience in the schools resulting from those decisions. The specific case of Industrial Science 12 - a senior secondary applied science introduced in British Columbia in 1965 - is examined in some detail as an instance of this disjunction.

Data for this study were gathered through archival searches and personal interviews. The archives of the former British Columbia Shop Teachers' Association and the personal papers of Professor Harry Cannon were the main sources of printed data. Personal interviews were conducted with members of the Course Development Committee, former Department of Education officials, School Board Supervisors, Shop Teachers' Association excecutive members, and teachers of the course.

The British Columbia educational milieu of that time is examined, including the effects of international curriculum development projects, the Royal Commission on Education (1960), and the Technical and Vocational Training Assistance Act (1961). The deliberations of the Department of Education and, more particularly, the Course Development Committee, are scrutinized. The reaction of the British Columbia Shop Teachers' Association to the course is analyzed. The brief existence of Industrial Science 12 in the schools of British Columbia is described. Finally, conclusions are advanced to explain the difficulties the course encountered, and implications for future curriculum development in this area are discussed.

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ACKNOWLEDGEMENTS

The successful completion of this thesis owes much to the support and encouragement received from my advisor, Dr. P. James Gaskell, whose enthusiasm and belief in the project never flagged. Valuable advice and assistance was also generously given by committee members Dr. Jane Gaskell, Prof. Bob Leduc, and Prof. William Logan. Many people gave freely of their time to be interviewed for this study and they also have my gratitude for their essential contributions. Finally, my deepest appreciation must go to my wife, Deborah, who magnanimously put up with both this thesis and her husband through it all.

Chapter 1

Introduction

This study investigates the disjunction between macro-level policy decisions concerning the curriculum and the lived experience in schools resulting from those decisions. This issue is examined through the history of one particular course which was introduced in British Columbia in 1965 and officially withdrawn in 1975 - Industrial Science 12.

The complex forces operating during the development and introduction of Industrial Science 12 make a study of that course a unique case in Canadian curriculum history. During this period the Chant Commission had examined education in British Columbia and made sweeping recommendations concerning the reorganization of the Senior Secondary program. Industrial Science 12 was one of the new courses which resulted from the Commission's recommendations. At the same time, the federal government became a major player in Canadian education at this time by providing funding for vocational education through the Technical and Vocational Training Assistance Act (TVTA) of 1960. Industrial Science 12 was accepted

under the terms of Program 1 (Vocational High School training) of the TVTA and thus qualified for federal funding. Industrial Science 12 was also unique in its attempt to be an interdisciplinary course, combining the methods of science with the utilitarian aspects of Industrial Education. In the social climate of the early 1960s, scientific/technical education was seen as a crucial element of national survival. The interdisciplinary nature of Industrial Science 12 was considered to be an important aspect of this technical education.

Importance of Study

The importance of researching local and provincial curriculum history has been emphasized by Tomkins (1979) and Shaw (1978). The national and international context of curriculum innovation in the 1960s, undeniable in importance and influence, is also the sum total of decisions made by provincial authorities in positions to prescribe curricula. The prevalent contemporary wisdom concerning curricula will be adapted to the local context, just as a specific subject curriculum will be adapted at the classroom level. The cumulative result of more

specific curriculum histories will be a more valuable national history of curriculum.

The recognition that public schooling does not unfold in a vacuum has avoided the "in-house" simplicity of early educational historians. However, this recognition has not been without its own problems. A complete understanding of the social history of a given time, were this possible, will not axiomatically result in a complete understanding of the particularities of a school subject. The contents of a school subject do not flow inevitably from national and international societal trends and decisions. The evaluation studies, research on innovation and implementation, and investigations of the classroom/school ecology of the past two decades have demonstrated the complex nature of schooling. A curriculum history must recognize that past events in education were no less susceptible to these complexities.

This study examines an area in which there has been remarkably little research - industrial education. Lux (1982) pointed out that no tradition of research as a part of professors' duties has developed in the field. The research that has been undertaken has contributed little to "the evaluation and generation of theories", and has made "little

substantive contribution" (p. 861). Because the "pace of change [is] so slow and the need for it so great", researchers "need to become much more knowledgeable about change phenomena". Although a beginning has been made, "the field is amazingly short on this kind of research" (p. 861).

The historical curriculum research that does exist concerning this field can be set, almost without exception, in one of two camps, both of which tend toward a macro-level analysis. Much historical work critical of secondary school industrial education courses emphasizes the vocational aspect. Many historians (Dunn, 1978; Morrison, 1974; Lazerson & Grubb, 1974; Wirth, 1972) have interpreted the role of industrial education in senior secondary schools to be the socialization of certain segments of society to industrial work norms and their place in society. There is also a body of "hortatory" histories (Barella & Wright, 1981; Barlow, 1967; Bennett, 1937), written by those within the field of industrial education, which describe its development and the obstacles it had to overcome to gain acceptance.

Despite this attention to context from the two disputing perspectives, the <u>content</u> of industrial education courses as school subjects has received little or no attention. The shifting "curriculum

emphases" (Roberts, 1982) of the subject tend to be ignored in the macro-level analysis utilized. A host of social factors at the individual and school level have also played a large role in determining the curriculum emphases of industrial education subjects, and what can count as industrial education. These also must be considered, along with the larger social context. If industrial education courses are, as is often suggested, the "dumping grounds" for the "lower classes" and "less able", that policy is continually created through the concurrence of participants in industrial education in specific subject contents and methods. A macro-level analysis of an Industrial Education programme will not suffice for a full understanding of the curriculum dilemma experienced in the school.

Research Questions

Despite the influential forces which engendered Industrial Science 12, the course had a very short, unsuccessful life in British Columbia schools; a frequent description of the course, given in teachers' vernacular, is that it was a "disaster". As an official course title, Industrial Science 12 lasted only ten years; as an established part of the

curriculum offered in a reasonable number of schools, its actual existence was only four or five years. This study attempts to achieve an understanding of the fate of this curriculum endeavour through three overarching questions which direct its investigations :

1. What societal pressures existed which lead officials to establish the Industrial Science 12 course ?

2. Did the course developers produce a workable curriculum in response to these influences ?

3. What constraints operating within the school lead to the ineffectiveness and eventual withdrawal of Industrial Science 12 ?

Overview of Study

Chapter 2 presents a review of the literature and establishes the theoretical framework for the study. This literature review examines the use of curriculum history and the value of case studies of curriculum innovation. The literature which examines

how the contents of a subject become defined in the curriculum is also reviewed, with particular emphasis on the work of Ivor Goodson.

The methodology of the study - including archival research, document analysis, and personal interviews - is described in Chapter 3.

The social and educational milieu in which Industrial Science 12 had its genesis is examined in Chapter 4, in response to the first research question. The general social climate of the time is briefly surveyed. The international efforts at curricular reform are noted. The educational context in British Columbia following the Chant Commission is examined, as are the curriculum changes in Science Education. The expectations held for vocational education and the Technical and Vocational Training Assistance Act are also reviewed.

The origin and development of the Industrial Science 12 curriculum are discussed in Chapter 5; this attempts to answer the second research question. The meeting notes of the Course Development Committee, and the original proposals of the committee members, are analyzed. Interviews with the committee members and Department of Education officials also contribute to this analysis.

Chapter 6 - corresponding to the third research question - examines the lived experience of Industrial Science 12 in the schools. The teaching of the course, the resources available, the perceptions of teachers and students, the problems which developed, the efforts to improve the course, and other issues are discussed.

Chapter 7 analyzes the findings of the previous three chapters and summarizes the study.

Chapter 2

Review of Literature

Curriculum history is a relatively new field within educational research. In the late 1960s, curriculum theorists, notably Kliebard (1968) and Bellack (1969), decried the ahistorical nature of much curriculum work. The curriculum innovations of the 1960s had paid little attention to previous curriculum experience and, Kliebard noted, "each generation is left to discover anew the persistent and perplexing problems that characterize the field" (1968, p.69). Goodson has characterized the reformers as embracing a belief that "history in general and curriculum history in particular could somehow be transcended" (1983a, p.3). The study of curriculum history as a distinct field within educational history was perceived as a means of overcoming this problem.

The value of historical investigation in studying the school curriculum has been argued by a number of researchers (Charlton, 1968; Davis, 1977; Hazlett, 1979; Stenhouse, 1978; Webster, 1976). Many curriculum specialists have promoted the concept of curriculum history as a field separate from educational

history. Tanner, for instance, notes that educational history "has been reinterpreted to include the broad range of educative agencies in the society - the home, church, and workplace" (1982, p.408). As a consequence of this broadening of educational history, Tanner feels that curriculum history is a necessity "to keep the curriculum from getting lost". Franklin (1977) also argues strongly for the distinction between educational and curriculum history. Reid (1985), Goodson (1983a), and Kliebard and Franklin (1983) also promote this viewpoint. However, Marsden (1979) expresses doubt that an organized sub-field would develop. He suggests there is little value in distinguishing between curriculum and educational history. Marsden concedes that curriculum specialists have special insights to bring to the study, but points out that the methods of historical inquiry must also be mastered by curriculum specialists. Logically, an historian could equally develop his expertise in curriculum studies. Davis (1977) has argued that curriculum history "must strengthen the relationship between itself and the history of education" (1977, p.165). Whether it is fruitful or not to worry about its status as a separate field within educational research, there is common agreement on the value of historical curriculum studies.

This value is expressed in a variety of terms. There is a strong current in the literature that sees historical studies as "usable knowledge" and emphasizes their utilitarian nature. Goodson, for example, states that "the preoccupation should ultimately be with history for the sake of contemporary curriculum issues" (1983b, p.10). Others, while admitting the value of historical studies, are more circumspect in describing their utility. Hazlett (1979), for instance, questions the value of seeking what he terms "immediate practicality" in the field.

Hazlett characterizes the curriculum field as one of "practical, normative activity carried on with urgency in a crisis atmosphere" (1979, p.131). While this might be overstating the case, it is certainly a practical endeavour and it is not surprising that the utilitarian benefits are emphasized. However, some caveats have been raised concerning the practical use of curriculum histories, of "raiding the past". Kliebard and Franklin (1983) caution against the search for "handy solutions" and "lessons" in historical studies (p.153). Stenhouse (1978) views curriculum history as being of utilitarian value for current educational practice, but has a subtle explanation of how this value would be put to use :

The utilisation of history ... works through

> the refinement of judgement, not the refinement of prediction.
>
> While predictive generalisations claim to supersede the need for individual judgement, retrospective generalisations seek to strengthen individual judgement where it cannot be superseded.
> (1978, p.22)

Stenhouse agrees that history can teach us "lessons"; to imitate, or to avoid imitating,the actions of others. More important, however, is the understanding history can give us of "the context of action and the interplay of action with context". For Stenhouse, "contextual understanding", the strengthening of individual judgement, is the prime value of historical case studies.

Investigations of specific curricula are often termed "case studies" or "historical case studies". Reid (1985) emphasizes that case studies enable researchers to see beyond macro-sociological explanations. Shaw (1978) promotes the importance of building an accumulation of historical case studies. Tomkins (1979) stresses the need for individual case studies as groundwork before an understanding of the national curriculum is possible. Tanner (1982) introduces a caveat, wondering whether "scattered historical studies by researchers are an effective means for dealing with precipitous actions by practitioners" (p.410). However, the cumulative value

of individual case studies is generally acknowledged in the literature.

Among curriculum specialists, British scholars such as Goodson (1983a; 1983b; 1983c), Goodson & Ball (1984), McCulloch et al.(1985), and Waring (1979) have used the historical case-study approach to examine innovations in science, and science and technology, education. Goodson has applied a socio-historical approach to the study of curriculum and, in particular, to the study of specific school subjects. Goodson views school subjects as representing the "deep structure of curriculum differentiation at work within contemporary schools" (Goodson, 1983a, p.4). Through historical case studies, he has traced the process of legitimating school subjects within the curriculum, and these studies have provided support for three hypotheses which attempt to explain the rise of school subjects.

Goodson's first hypothesis is that school subjects "are not monolithic entities, but shifting amalgamations of sub-groups and traditions". These sub-groups, depending on their influence, serve to define the "boundaries and priorities" of the subject in schools (p. 3).

His second hypothesis is that in the process of establishing a school subject, subject groups "tend to

move from promoting the pedagogic and utilitarian tradition toward the academic tradition" (p. 3). By "pedagogic" tradition, Goodson refers to "personal, social and commonplace knowledge" which places " 'the way the child learns' as the central concern in devising subject content" (p. 27). "Utilitarian" refers to practical knowledge, often related to non-professional vocations, for which written examinations are considered inappropriate. The "academic" tradition is "content-focused and typically stresses abstract and theoretical knowledge for examinations" (p. 27). In contrast with the pedagogic and utilitarian traditions, the academic tradition is seen as conveying high status.

Goodson's third hypothesis states that "much curriculum debate can be interpreted in terms of conflict between subjects over status, resources and territory". School subjects are seen in a hierarchy of status attainment, with those subjects taught to the "most able" students being the highest in status and achieving the greatest rewards in terms of resources and territory.

The accrual of status and its consequent rewards is not only dependent on the relative esteem between subject groups, but also applies to different kinds of knowledge <u>within</u> subjects :

> The differentiated status of academic, utilitarian and pedagogic traditions pervades both the type of subject and the <u>internal form</u> of each subject.
> (p. 202) (emphasis added)

The differentiated status among particular subjects in school may seem obvious to observers, but Goodson's contention that the internal form of a subject is also responsive to the desire for status is more pertinent to this study of possible shifts in the subject matter of an industrial education course.

Goodson's hypotheses provide a pertinent basis for this study; Industrial Science 12 could be viewed as an instance of the move of a utilitarian subject toward a more academic rationale for itself. A desire for increased status on the part of a traditionally low-status subject area might have been one of the reasons for this. The success or failure of the endeavour might have resulted from the influence of the various interested sub-groups. The applicability of Goodson's hypotheses for explaining the policy decision behind Industrial Science 12, and its fate in schools, will be examined in this study.

Chapter 3

Methodology

Histories of specific curriculum projects are often termed case studies. The concept of a "case" has been criticized as being "so general and vague as to be of no methodological value" (Atkinson & Delamont, 1985, p.29). Stenhouse, in his work with the Centre for Applied Research in Education at the University of East Anglia, has much experience in the use of case studies and attempts to apply some methodological rigour to the question. He states that:

> the basis of verification and cumulation in the study of cases is the recognition that a case is an instance, though not, like a sample, a representative, of a class and that case study is a basis for generalisation and hence cumulation of data embedded in time. It is the classic instrument of analytic as opposed to narrative history.
> (1978, p.21)

Stenhouse views the study of cases as proceeding through two stages: first, the "case data" and "case record". The case data include all materials assembled by the researcher. The case record would be a condensation of the data, edited "without explicit comment" (p.37). The second step would be the presentation stage: the "case study" and "analytic survey". In this model, the case study is "an

interpretive presentation and discussion of the case, resting upon, quoting and citing the case record for its justification" (p.37). The verification of a case study depends upon the same criteria which apply to history; that is, "a communal, critical discussion of evidence which is accessible on the same terms to all scholars...[and] the achievement of a critical intersubjectivity" (p.22).

In Stenhouse's terms, the case data for this study were gathered from two types of sources : document analysis and personal interviews.

The two basic forms of document data may be categorized as public archival records and personal records. The most important public archive for this topic is that of the British Columbia Industrial Education Association, formerly the British Columbia Shop Teachers' Association (BCSTA). This archive contains the various publications (newsletters and journals), meeting minutes, committee reports, correspondence, workshop agenda, and miscellaneous papers of that Professional Subject Association (PSA) of the British Columbia Teachers' Federation (BCTF). As Industrial Science 12 became almost solely the responsibility of industrial education teachers, the reactions of this PSA over the life of the course are critical. This archive includes the official

positions of the BCSTA and, through correspondence, minutes, and surveys, also documents the views of individual industrial education teachers.

The Report of the 1960 Royal Commission on Education (RCE), commonly known as the Chant Commission after its Chairman, and the individual briefs presented to that commission were examined. This commission influenced the reorganization of secondary schooling which resulted in the establishment of Industrial Science 12.

Official publications of the British Columbia Department of Education, since renamed The Ministry of Education, were also examined. These included the various curriculum guides and programmes of study for Science and Industrial Education, the Administrative Bulletins, Curriculum Circulars, equipment lists, and so forth, designed for use by school personnel. Also included in this group were the Department Of Education's Annual Reports throughout this period, which describe the establishment of the reorganized Senior Secondary Programme, the Vocational Course Writing workshops, the provincial response to the Technical and Vocational Training Assistance Act, statistical analyses of student programmes, and occasional references to specific courses such as Industrial Science 12.

Where appropriate and available, the records of the BCTF, other PSAs (especially the British Columbia Science Teachers' Association), and the Vancouver School Board were also investigated.

The personal records of many of the key players involved with the development and implementation of Industrial Science 12 were also studied. School board coordinators, provincial inspectors and advisors, teacher-training personnel, and individual teachers of Industrial Science 12 all shared their personal papers relating to the course.

Among the personal records, the papers of the Chairman of the Industrial Science 12 Course Development Committee were of crucial importance. These included the minutes of all but one meeting, as well as the various draft materials submitted to the committee as it deliberated the concept of a science course for industrial education students. Other committee members also had retained private records of their involvement with the course development and willingly allowed them to be studied.

The second major focus of the case data was achieved through interviews. The decision as to whom to interview was based on interpretation of the data in the BCSTA archives. Those who had played significant roles in the history of the course were

noted as the archival data were studied. No predetermination was made as to what could be considered a "significant" role; the relative significance of individuals unfolded as the data were studied. As the interviews were conducted more than twenty years after the development of Industrial Science 12, not all key players could be found. Those who were interviewed often suggested additional contacts for further interviews.

Among those interviewed were the President of the BCSTA during the implementation period of Industrial Science 12 and the BCSTA member who undertook a study of the course for the BCSTA; the Department of Education's Coordinator of Industrial Education and the two Technical Advisors employed by the Department; the Director of Vocational Curriculum during the 1960s; a retired, and the current Supervisor of Industrial Education with the Vancouver School Board; a member of the industrial education teacher-training faculty of UBC; and, members of the Vocational Course Writing teams who undertook the revision of the Industrial Programme in the early 1960s.

Six teachers familiar with the course were interviewed; only one science teacher who had taught the course could be located for these interviews, the rest being industrial education teachers.

Three interviews were conducted with members of the crucial Course Development Committee. The Chairman of the six-member committee was dead and two other members could not be located.

Because Industrial Science 12 became predominantly within the sphere of Industrial Education, specialists within this area comprised the majority of interviews. The writer's experience as an Industrial Education teacher proved useful in comprehending the "language", in an ethnographic sense, of respondents. However, the problems which this enculturation can present were recognized and respondents were encouraged to elaborate on points rather than to rely on the tacit knowledge of the interviewer.

The format of the interviews may be categorized as the semistructured interview type (Borg & Gall, 1983). It was assumed that no one schedule of questions would be sufficient to elucidate the views of those such as Department officials and classroom teachers who would hold differing perspectives on a programme. Certain types of information were desired from all respondents, but the semistructured approach allowed a rephrasing of questions and their order of presentation during an interview. It also allowed questions and avenues of investigation to be

reformulated based on the experience of previous data. As facts and interpretations were rechecked with successive interviews, data reliability was increased. The semistructured approach is also sufficiently conversational that respondents could elaborate on matters of individual concern.

Interviews with those who were connected with the beginnings of the course emphasized the impetus for the course: the Chant Commission, the TVTA Act, the Department of Education's activities, the revision of the Industrial Programme, the actual writing of the curriculum, et cetera. The data from these interviews are most strongly seen in Chapters 4 and 5 of the present study. A second approach, which emphasized Industrial Science 12 in the schools - how it was taught, who taught it, teachers and students' reactions to it, its strengths and weaknesses as a course - was used with those teachers, Technical Advisors, and Coordinators who dealt with Industrial Science 12 on a daily basis. These data are most evident in Chapter 6.

These "case data" were then edited to form what Stenhouse termed the "case record". A chronological account of the history of the course was developed. As well, all data pertaining to certain crucial themes were compiled around these themes - for example, the

push for revisions in the Industrial Programme, the disagreements among the Course Development Committee members, the difficulties experienced by teachers, et cetera.

The presentation stage, or case study, of these data follows in Chapters 4, 5, and 6, while Chapter 7 analyzes the findings.

Chapter 4

Societal Influences on Industrial Science 12

Industrial Science 12 was a response to two overwhelming influences upon British Columbia education in the late 1950s and early 1960s : The British Columbia Royal Commission on Education, appointed in 1958 and which reported in 1960, and the Technical and Vocational Training Assistance Act, passed in late 1960. Both of these factors resulted from the increased public emphasis on the economic and political importance of education, and the perception that the present educational curriculum was inadequate.

In Canada, a serious recession and high unemployment levels during the late 1950s lead to calls for a shift in educational priorities. As in the United States, the perceived extremes of "progressivism" were being challenged and the Cold War seemed to require a new rigour in Western education. The 1957 launching of Sputnik is often taken as a signpost of this directional change. The role of education became a subject of national debate, especially in the United States, where Sputnik, as Admiral Rickover said, did its greatest damage "to our

trust in the American educational system" (Rickover, 1959, p. 157). This turmoil resulted in unprecedented study of, and federal involvment with, education in both countries.

The National Defense Education Act (NDEA) passed by the United States Congress in 1958 presaged the dual, and sometimes conflicting, approach which would be attempted to overcome the alleged deficiencies. The NDEA provided funding for programmes in "academic" science and math, but also infused federal funds in technical training. New curriculum projects which strove to introduce intellectual rigour into the schools, such as those associated with Bruner's theories, also received unprecedented support and study. Concurrently, vocational education was being championed by Conant (1959), and others, to great effect.

In Canada, similar concerns were expressed about the educational systems of the provinces, although in a "characteristically cautious and typically derivative" manner (Tomkins, 1981, p. 164). All four Western provinces established royal commissions to study education during the late 1950s. In the Canadian debate, much greater emphasis appears to have been placed on the economic, rather than geopolitical, arguments for a revamping of school programmes. For

example, the Alberta Royal Commission on Education (ARCE) had, as one of its major terms of reference, the mandate to consider "[t]he relationship of the educational system to the requirements of industry and the modern community" (ARCE, 1959, p. 5). Among its recommendations were the following with respect to vocational education :

> That the requirements of general education be reviewed with a view to devising clear distinction between general education courses and vocational courses.
> (Recommendation 101)
>
> That present electives of near-vocational nature and intent be reviewed, if necessary, so that they may become acceptable to business and the trades.
> (Recommendation 102)

Similar concerns of an economic nature were being expressed about British Columbia's educational system, culminating in the appointment of a Royal Commission to investigate the perceived problems.

British Columbia Royal Commission on Education

The British Columbia Royal Commission on Education was commonly referred to as the "Chant Commission" after its Chairman, S.N.F. Chant. The Minister of Education, L.R. Peterson, announced the appointment in January of 1958. (1) The Commission's mandate was to examine "in the light of world

conditions the adequacy of the basic educational philosophy of the British Columbia educational system" (BCDE, RCE, 1960, p. 1). The Royal Commission on Education report noted diplomatically that its appointment "did not arise from any widespread or exceptional discontent" but because "the time seemed opportune for an independent review and assessment 'in the light of world conditions'" (p. 2).

The Commission's report insistently emphasized two themes - the national importance of education and the rapid rate change in the modern world . Section One of the report - Scope and Methods of the Commission - presented the case for this perspective. For instance :

> Any short-sighted view of education is not suited to the modern world...the conditions under which we live change at an ever-increasing rate....
>
> It is no simple matter to envisage the world in which the children...will live all their lives.
>
> In view of the complex and rapidly changing world of the present and the uncertainties of the future....(p.3)

With a sidelong glance at Sputnik, the Royal Commission on Education noted:

> A few years ago the possibility of launching earth satellites was a fantastic dream, but due to the vigorous approach of modern science they are commonplace today. 'In the light of world

> conditions' modern education must adopt a similarly vigorous approach.
> (p.3)

The dominant theme in the Royal Commission Report was unquestionably the national economic importance of education. As the Commissioners noted, in referring to the then-current debate concerning education:

> This awakening to the national importance of education does not stem wholly, or perhaps even mainly, from an increasing regard for the cultural and intellectual values of education. On the contrary, a large part of the present day concern for education is based upon a hard-headed regard for the significance which an up-to-date educational system has for the economic future and security of a nation.
> (p. 411)

The report then continued to make the case for education's economic importance :

> In the modern world a sound educational system has become essential for economic development and continued prosperity. Outstanding leaders in practically every major country of the world have publicly recognized that the struggle for economic supremacy will depend as much upon effective educational systems as upon any other factor of national life.
> (p.411)

> If Canada is to be strong, Canadian education must be strong, and if Canadian education is to be second to none in the world of today and tomorrow, far-reaching proposals must not be rejected....(p.3)

> Any country today that does not devote increasingly large sums to education will inevitably lose whatever place it has in world affairs, whether commercial or otherwise.

(p.411)

The Commissioners concluded their case with :

> It follows that the people of British Columbia must give their fullest support to, and maintain a continuing vital interest in, their educational system or fall behind in both economic and cultural status. Moreover, any failure on the part of the provinces regarding education will imperil the future of the whole nation.
> (p.412)

This theme of national economic survival coloured many of the Royal Commission's recommendations and its opinion concerning the primary aim of education followed directly from this premise.

The Chant Commission maintained that the primary aim of education must be the "intellectual development of pupils". The commissioners rejected aspects of "progressivism" they found in the schools, and deplored the number of optional courses in the curriculum, calling instead for a more structured program in the secondary schools, a lengthened school day of six hours (p. 64), a lengthened school year of 200 days (p.66), and a full Grade 13 programme (p.128). In almost every aspect of the curriculum, the commissioners decried the prevailing lack of standards.

In the senior grades, the Chant Commission recommended the establishment of three separate

programmes : a Senior Vocational Course, an academic program for university entrance, and a technical program for entrance to a technical or commercial institute. The Senior Vocational Course would be offered in a composite or vocational/technical school, while the other two programs would share a "collegiate academy".

The proposed Collegiate Academy would be given that appellation "to indicate that [its] educational status would be superior to that of any present senior high school". The students "would form a highly selected group", and "the standards of work required of them could be raised considerably above the University Programme in the present senior high schools" (p. 274).

Of the two programs proposed for the Collegiate Academy, the academic would include Grades XI, XII, and XIII, while the technical would include only XI and XII. In the academic program increased time would be allotted to English, Math, Social Studies, Languages, and Science; all electives would be related to university courses rather than, for example, Music or Industrial Arts. The technical program would place an emphasis on Science and Math, and advanced courses in English and Social Studies would be compulsory; the electives in this programme could include such courses

as Agricultural Science, Business Administration, Dietetics, Merchandising, Practical Science, Draughting, Dress Designing, Economics, or Secretarial Practice.

The Commissioners took pains to point out their expectations for this technical programme, as opposed to the Senior Vocational Programme:

> There has been a somewhat prevalent opinion that technical or business courses are intended to cater to the interests of those who lack ability in academic fields, but who can continue in high school by taking technical electives and some academically easy courses. This opinion greatly underestimates the standard of the technical or business courses proposed in this plan for Grades XI and XII. The pupils who continue at school merely to get some technical electives would not be interested in the high scholastic level of this course. Such students belong in the senior vocational course, not in the collegiate academy technical programme.
> (BCDE, RCE, p. 275)

The report contained a number of recommendations with respect to vocational education, sometimes couched in a disconcerting fashion. It advocated a Junior Vocational Course for repeating and lower-achieving pupils in Grades VII and VIII - "A large part of the course should be devoted to practical and occupational subjects" (p. 265). The science courses in the Junior Vocational programme would stress "applied aspects, nature study, household applications, electrical appliances,

mechanics, and the like" (p. 265). The commissioners expressed the hope that this course would increase the students' chances for employment, but also noted parenthetically that "their presence in the regular high school classes has a depressing effect upon the standard of work that can be set for the regular pupils" (p. 265).

The aim proposed for the Senior Vocational Course essentially concurred with that already stated in the Department of Education Administrative Bulletin :

> The objective of the Vocational Programme is to train selected pupils in the skills, technical knowledge, attitudes, and habits necessary for successful employment and advancement in skilled occupations....A Vocational Programme...is based upon the assumption that the pupil is going to take a specific line of work and that specific preparation related to this and taken along with his general education is essential for entry into gainful employment. (Quoted in BCDE, RCE, p.272)

This Senior Vocational Course, according to the Commission, would provide "specialized training in some skilled occupation" (p. 272) and be related to existing apprenticeship programs. Yet, the Report asserted that the curriculum "would provide for a high level of both general and vocational training" (p. 272). Many employers, in briefs submitted to the Commission, had stated that a good academic background was needed, as well as vocational training. The Commissioners agreed with this sentiment:

> This in no way minimizes the importance of vocational subjects in the school programme, but supports the view that the courses should not be excessively slanted toward trade training.
> (p. 273)

This crucial dilemma - how to provide "specialized training in some skilled occupation", while not being "excessively slanted" toward it - is, not surprisingly, unresolved in the Report's recommendations.

The Royal Commission Report engendered heated debate throughout the province. Its proposals were charged with being elitist by some, while others viewed them as being eminently realistic. Some major recommendations, such as the establishment of "collegiate academies", were not adopted, yet other suggestions did receive a sympathetic hearing within the Department of Education. As was the case in Alberta , it was the General Programme, not the Academic, which was perceived as being most in need of improvement.

The Deputy Minister, Dr. J.F.K. English, conceded in a 1962 address to British Columbia Principals that the High School General Program did not have well-defined goals :

> This certainly was the opinion of the Royal Commission. Consequently, the most important

> part of our work in the next few years will be to improve and strengthen that area from Grade X to Grade XII, which we recognize as the General Program, but which now we propose to call the Vocational Program.
> (English, 1962, p. 80)

The Department's decision to implement a revised vocational programme, not a "general" one, did not conclude the debate in British Columbia. The General Secretary of the BCTF, C.D. Ovans, expressed the view that "branching off into programs as the answer to individual differences is an admission of failure" (BCTF, 1965, p. 22). Another BCTF official, J.A. Spragge, stated at a CTF conference that :

> One of the tragic consequences of uncritical acceptance of the investment concept of education is causing grave concern in my province at the present time. It is a strong emphasis on courses of obvious vocational intent.... Education is being jostled off the sidewalk by the new fetish of vocational training.
> (Spragge, 1965, p. 3)

The Technical and Vocational Training Assistance Act

The Royal Commission on Education was not alone in providing an impetus to curriculum change in British Columbia at this time. The Federal Government had dramatically increased its presence in the field of education with the passing of The Technical and Vocational Training Assistance Act (TVTA) of 1960. The

possibility of using federal monies to fund programs in the high schools proved irresistible and almost all provinces altered, to some degree, their secondary level programs to take advantage of this funding. (2)

Although Canadian provinces were usually protective of their jurisdiction in education, the federal government had a long history of funding various "technical" or "vocational" programmes, with provincial acquiescence. The first federal involvement resulted in the Technical Education Act of 1919, which had its genesis in the Royal Commission on Industrial Training and Technical Education (RCITTE).

This Commission, chaired by James Robertson, who had helped to introduce Manual Training to Canada through the MacDonald schools, was established by the Laurier government in 1910 and reported in 1913.(3) Laurier was very careful to receive unanimous approval of the provincial premiers before establishing this Commission (Stamp, 1971). The published report of the Commission goes so far as to reproduce, in its introduction, the responses received from the premiers, and it stressed that education must remain under provincial control. The Act's funding of $10,000,000 for a ten-year period was less than the Commission's recommendation of $3,000,000 annually, yet the funding was not fully used by the provinces.

Only Ontario, in a pattern which was to be repeated, used its full share of the funds based on the plan for vocational education developed by John Seath in 1910 (Seath, 1911). Manitoba, which had established its own Royal Commission on Technical Education, was the only other province to study vocational education needs. Fluxgold notes that the effect of the TEA of 1919 was to encourage the provinces "to establish a program quickly....[I]n effect, to encourage the establishment of poor programs" (Fluxgold, p. 113).

This first federal involvement foreshadowed the results of later "training" programs. Federal involvement in vocational education, as was the case with the RCITTE, continued to be justified on the basis that the Federal Government was responsible for the economy. Vocational education was viewed as a necessary element of an industrialized economy, properly the responsibility of the federal government; its role as education *per se*, a provincial responsibility, was downplayed. The lack of enthusiasm on the part of most provinces, based on the difficulty of raising the matching contributions within a strict time frame (Dupre et al., p.14), also insured that the constitutional issue did not become an important one. This unenthusiastic response continued throughout the

various renewals and permutations in the four decades following the original act of 1919. (4)

The Technical and Vocational Training Assistance Act of 1960 encompassed all federal-provincial activities in the field of vocational education. Two agreements came into being with the TVTA: one covered apprenticeships, but the more important was the Technical and Vocational Training Agreement, which included ten separate programmes. For the purposes of this study, Program One - Vocational High School Training - is the central programme.

Program One provided funding for courses of study in which one-half of the students' time was given to developing occupational qualifications. (5) Unlike the matching (50%) grants of the earlier Acts, the Vocational High School Training agreement provided for a federal contribution of 75% of capital expenditures for projects approved by March 31, 1963. (Future extensions changed the deadline to March 31, 1967, or even later by agreement.) The original 1963 deadline forced provinces who wanted to avail of the federal grants to act quickly. Operating grants were at the 50% rate for the life of the agreement.

For a number of reasons, the provinces reacted much more favourably to the TVTA than they had previous agreements. The economic downturn of the

late 1950s and early 1960s lead to post-war highs in unemployment; even those with little faith in such programmes would have found it politically difficult to decline to participate. Cold War worries occasioned by Sputnik had brought to prominence the importance of technical training. As Dupre has indicated, the costs of educating the burgeoning post-war student population was another factor in enticing provinces to accept federal grants (Dupre, p. 18).

The effects of the Technical and Vocational Training Assistance Act - "the largest federal intervention in Canadian schooling ever undertaken" (Tomkins, 1986, p.298) - were dramatic and, in many cases, unintended. In Ontario, the province which made the greatest use of the TVTA, student enrolment in vocational courses doubled during the years 1960-1967, to 46.4 per cent of the student population, which was "clearly not envisaged when the federal government made the original offer" (Cameron, 1972, p. 163).

The original intention of the Vocational High School Agreement had been the creation of provincial trade schools and institutes of technology. Based on provincial data, the estimated cost of capital expansion for the six-year life of the agreement was $ 90 million, with $ 15 million earmarked for Ontario.

In March, 1961, the federal government agreed (perhaps at the instigation of Ontario Premier, John Robarts) to fund vocational high schools and vocational sections of composite high schools. Following this decision, provincial use of the programme expanded dramatically. The year 1961-62 alone saw the approval of almost $333 million in capital expenditures, with Ontario receiving $ 230 million, more than 15 times the estimated cost for the entire life of the agreement.

That some provinces hurried to alter programmes of study to take advantage of the federal grants appears undeniable. Dupre (p.18) refers to the TVTA beckoning "like a shining beacon" to the provinces, some of which were "almost unseemly in their alacrity" to take advantage of it. Cameron (p. 176) refers to the Ontario "Robarts Plan" as being "developed under conditions of utmost haste", although Fluxgold (p.114) charitably viewed Ontario as merely seeming "to anticipate the TVTA Act". A telling comment came form a provincial deputy minister who stated that the influence of the TVTA was so great that "for three years, John Diefenbaker was the director of curriculum for Canada" (Orlikow, 1969, p. 133, in Anderson, 1980, p. 106).

Alberta and Ontario were the most diligent provinces in obtaining federal grants; by August 31, 1967, Alberta had claimed 86.8 per cent of its possible allocation, while Ontario had claimed 80.3 per cent. In contrast, British Columbia had only received 48.8 per cent. This was a matter of concern to some individuals who felt that British Columbia had been "slow off the mark".

The propitious confluence of TVTA funds and the debate sparked by the Chant Commission provided the opportune setting for the reorganization of the British Columbia Senior Secondary Programme. The Department of Education began an intensive review of programmes and courses, including the Vocational Programme and high school science. Industrial Science 12, which neatly addressed many of the public concerns, was to prove a key element in this reorganization.

1. Alberta's Royal Commission on Education had been established on December 31, 1958.

2. Newfoundland was the only province to concentrate solely on post-secondary training.

3. World War I caused the enactment of The Technical Education Act to be delayed until 1919.

4. These permutations took many forms. The Unemployment and Agricultural Assistance Act (1937) was designed to provide training for unemployed workers between 18 and 30, and federal funds were to be matched by provincial expenditures. The Youth Training Act (1939) continued similar programmes but the provinces were not required to match the federal funds. A War Emergency Training Programme (under the War Measures Act) also provided full federal funding for technical education. The Vocational Training Coordination Act (1942) was an attempt to consolidate and coordinate the many programmes in existence at that time (Glendenning, 1965, p. 20). Many separate agreements were established as a result of this Act, including the Vocational Schools Assistance Agreement which provided secondary-school level vocational training. Although the provinces collected much federal funding for operating purposes, Dupre (p. 15) notes that few programmes used the conditional matching grants available for capital expenditure, less than half the federal allotment being used. Provinces were less easily persuaded if they were required to match any grants.

5. The grants were specifically excluded from being used for Industrial Arts, or "general shop"-type, facilities and programmes (Cameron, p. 167).

Chapter 5

The Development of Industrial Science 12

Planning for "appropriate vocational courses and programmes for pupils in Senior Secondary schools" began in the summer of 1962 (BCDE, Annual Report [AR], 1962/63, p. W43). Although the entire senior secondary programme was to be reorganized, the most dramatic changes were to take place in what had been the General Programme, which had remained intact since the early 1950s. The Director of Vocational Curriculum recalled that they "wanted to try to give a little status" to this programme, which was a "meaningless hodge-podge" and seen as only for those who "couldn't cut the university programme" (Henderson, 1984).

The science course in British Columbia had received much criticism in the Royal Commission on Education briefs and hearings (RCE, p. 313), and a revision of the General Science had been recommended. Many schools had been offering Modified Science 10 courses, which were a "judicious selection of appropriate content from both Science 10 and 20" and which might be "advisable for slower-learning pupils and for those whose interests lie in special fields " (BCDE, The Sciences-1959). These modified courses were

to be "terminal" science courses and would not allow the student to continue on to Science 20. By late 1961, the Department of Education had apparently decided that a "vocational science" course was necessary (BC Science Teachers Association, Newsletter (3), 2). Early in 1962, a committee of Industrial Education department heads from Vancouver schools, representing the British Columbia Shop Teachers Association, had responded to questions asked by F.P. Levirs, the Chairman of The Professional Curriculum Committees :

> Q. Is there a need for a more practical science course - a pre-vocational science course - to enable students in the pre-vocational program to cope with new industrial processes that so often involve science at any level of employment ?
>
> A. There is a need for a more practical science course but the work should be correlated with the practical subjects - NOT overlapped. (BCSTA, Misc. Papers)

In July, 1963, a group of Department of Education officials and secondary school teachers, meeting at Burnaby Vocational School, served on three course-writing teams to prepare draft outlines for the vocational courses. These outlines were to be "revised and developed into full courses" for implementation in September, 1965 (BCDE Curriculum Newsletter, Oct. 1963). The Director of Vocational Curriculum at that time remembers the aim was "to develop courses, and to

do it quickly, hurriedly, but get them out so that in 1963/64 they could come in for criticism, review, and so on". (Henderson)

The Department had tentatively settled on three separate divisions within the overall Senior Vocational Programme : Vocational Commerce, Vocational Industrial, and Vocational Service. Within each program, further specialization was to be possible. For example, the Vocational Commerce Programme would allow specializations called Secretarial, Accounting, or Business; the Vocational Industrial Programme would allow specializations in Construction, Mechanics, or "Specific Trades". The three course-writing teams established by the Department corresponded to these three divisions within the Senior Vocational Programme. It was within the Vocational Industrial Programme that three new course names - Industrial Math 11, Industrial Power 11 & 12, and Industrial Science 12 - appeared in the Department's proposal.

The three writing teams concentrated on the outlines for the various subdivisions of the Senior Vocational Programme. Their recommendations were published by the Department, soon after the July, 1963 meetings, in what came to be called the "Grey Book". This Grey Book was then circulated throughout

British Columbia during the school year 1963/64 to elicit responses from interested parties.

The British Columbia Shop Teachers' Association (BCSTA) Curriculum Committee responded to the Grey Book following an Executive meeting in October, 1963. Its report was directed to the British Columbia Teachers' Federation (BCTF) members of the Professional Committee on Senior Secondary Curriculum. The BCSTA Curriculum Committee (BCSTACC) approved most of the proposal for the revised Senior Vocational Programme, but recommended more specialty areas within the Vocational Industrial Programme. In addition to the Construction, Mechanics, and 'Specific Trades' areas proposed by the Department of Education to fall within that programme, the BCSTA recommended specialties in Electronics, Graphic Arts, and Power Mechanics.

In promoting the idea of specialties in Electronics and Power Mechanics, the BCSTA committee noted that:

> Unless it is intended that Industrial Power 11 become a strictly theory course, there is far too much material to be covered in one year by even the best of students. Surely it is not intended that the Vocational Industrial Program be a theory program.
> [BCSTACC, Report, Oct. 29, 1963, p. 1]

This comment from the Curriculum Committee of the Shop Teachers' Association was the first indication of the dilemma faced by those charged with developing applied science courses for the Vocational Industrial Programme. The resistance of the BCSTA to a "theory program", as appeared possible with the introduction of the three new courses (especially Industrial Power and Industrial Science), was stated only three months after the first Vocational Programme meetings of July of 1963. In a December, 1963, meeting between the BCSTA Executive and representatives of the writing teams, a related caveat was noted concerning "the level of achievement anticipated by [sic] the students" (BCSTA Minutes, Dec. 13, 1963).

The BCSTA Curriculum Committee response to the "Grey Book" also foreshadowed the other aspect of the development of these new courses which was to prove crucial - the perceived necessity of obtaining Federal funding. The BCSTA Curriculum Committee recommended that the proposed section of the Industrial Power course dealing with Industrial Electricity be placed in the Specific Trades area "where it is possible to get Federal grants for the very costly equipment". [BCSTACC, n.d.]

The Curriculum Committee of the BCSTA concurred with the Grey Book proposal that each specialty within

the Vocational Industrial Programme would have a course called Industrial Science 12. The committee took pains, however, to emphasize that the course should be directly related to the specialty area and not be a generic course; that is, five distinct Industrial Science courses were envisaged by the BCSTA. The committee also stated a concern similar to the one expressed with respect to Industrial Power - that the Industrial Science 12 course "should be taught by industrial education teachers who have a practical and theoretical background". [BCSTACC ,n.d.]

The BCSTA vice-president reported in March of 1964 that it had "been suggested" - presumably by the Department of Education - "that we work together with the Science Teachers' PSA on the Industrial Science course" (BCSTA Minutes, March 30, 1964). (A meeting of two respective executive members was arranged but no record of what transpired, or confirmation that the meeting was held, could be located during the present research.) The precise status of Industrial Science - whether it was to be considered a science course or an industrial education course - was apparently still in doubt. The BCSTA Newsletter for March, 1964, notes that "[i]t should be kept in mind that industrial education teachers will in many instances be teaching these new courses." Although the Curriculum Committee

of the BCSTA had recommended that industrial education teachers be the ones to teach the course, at this juncture it was still unclear whether Industrial Science would come solely within its province; the BCSTA noted only that "in many instances" industrial education teachers would be responsible.

The Vocational Course writing teams met again during Easter and the summer of 1964, having noted the comments made throughout 1963/64 on the Grey Book proposals. The Department's Annual Report described this "extensive" project which "involved 28 persons for 10 full days in writing curriculum guides" (BCDE, AR, 1964/65, p. D50).

Despite the concerns expressed by the BCSTA Curriculum Committee respecting the correlation of Industrial Science with the other industrial courses, the Department had decided that the writing of the science and math courses of the Vocational Programme would require different treatment. In a letter to one of the members of the Vocational Industrial writing teams, the provincial Director of Curriculum, J.R.Meredith, noted that all courses in science and math for the Vocational Programmes, including Industrial Science, would be prepared in final form by committees established solely for that purpose. This was because there existed "some likelihood of having

duplications and conflicts in materials" with the math and science courses in the other Vocational Programmes.

Although the final curriculum of the science course was not to be the responsibility of the vocational writing teams, Meredith assured the vocational group that their conception of the course was understood by the Department :

> [i]t will still be necessary for the vocational industrial team to set forth as clearly as possible at least some of the content material needed or valuable from the point of view of the pupil taking an industrial programme.
>
> The mathematics and science material can be presented simply as raw material for incorporation in final form by the committees concerned. Those who feel that such courses might become "unduly academic" and lose their practical application should know that we are aware of this and will take it into account in the revision of these programmes.
> (Letter to B.H. Campbell, May 14, 1964))

The course revision and development work at the 1963 and 1964 workshops was performed by small groups of two or three teachers for each course. However, the initial development work for Industrial Science was assigned by the Department to an individual teacher. F. W. Hancock, described by a Department official as one of the "old British 'mechanics'", was the sole course writer for Industrial Science during the 1964 workshop. A teacher who taught with Hancock at Vancouver Tech remembered that he "came from more of

that math-science background, less in the shop area...[and] I don't think that was a good choice because that only added to the esoteric/theoretical aspect." Hancock, who had been teaching industrial courses at Vancouver Tech, "didn't work out in a shop course" and "they had him teaching math." The Coordinator of Industrial Education during that period thought Hancock's material from the summer session was "unusable" for the course:

> I remember him well. He had a lot of material there but he didn't seem to register too much with the rest of the organization. He had good ideas and had good thoughts but it didn't come together as a course.
> (Jupp, Interview, 1984)

The Supervisor of Industrial Education for Vancouver recalled discussing the perceived theoretical slant of the material with Industrial Education teachers , "but we couldn't get this other man [Hancock] to change his mind at all" (Cuthbertson, 1984). The reservations expressed by industrial education teachers about the course relying overly on theory were borne out by this first material presented for Industrial Science.(1)

Early in the Fall of 1964, the Department realized that the Industrial Science course could not be ready for the introduction of new programmes in September, 1965. (As a grade 12 course, its

implementation was not essential in the first year of the programme.) The Coordinator of Industrial Education, Joseph Jupp, pointed this out to the executive of the BCSTA in an October, 1964 meeting. (BCSTA, Newsletter, Oct. 1964). In November, 1964, the Department of Education decided to establish a separate course development committee to prepare the Industrial Science course. Professor G.H. Cannon of the Faculty of Education, UBC, was requested by J.R. Meredith, the Director of Curriculum, to chair this Industrial Science 12 Course Development Committee. In his letter to Prof. Cannon of November 9, 1964, Meredith stated that what was needed was "an outline based on suggested material developed last summer" [i.e., that developed by Hancock] :

> Since there has already been some work done on the problem, I do not anticipate a long and intensive study by the committee. Indeed, I hope that we may be able to issue, at least in temporary form, an outline for the course in the spring of next year.

The aim of the Industrial Science 12 course, as Meredith explained it to Prof. Cannon, was :

> to provide for one year of study of the principles, products, and processes of science in industry as closely related as possible to the Industrial Education courses and the occupations for which they are preparing pupils.

As in his letter to B.H. Campbell, noted above, Meredith emphasized the need to stike a balance in developing a science program for Industrial Programme students:

> The problem is to avoid on the one hand a sort of mass descriptive, informational type of course in applications of science and on the other hand, a very theoretical type of course, the significance of which would be difficult for these pupils to grasp.
> (Meredith, Letter to G.H. Cannon, Nov. 3, 1964)

Prof. Cannon had been a high school science teacher who had also taught electricity at Vancouver Tech, prior to joining the Faculty of UBC. Cannon was intensively involved with the physics course revisions at this time, but his experience in a trades area as well apparently made him an obvious choice to chair the committee. The remaining committee members were D.V. Winteringham, who had worked with "modified" science courses at Vancouver Tech, and R.E. Phillips, also a science teacher; H. Kirchner, an Industrial Education teacher, and W.R.F. Seal of the Industrial Teacher Training Unit. (2) J.R. Meredith attended the first two meetings of the committee as the Department representative. Commencing with the third meeting, the Department representative was R.I. MacLoughlin.

The first meeting of the Course Development Committee was held on December 2, 1964, with all

members present. This meeting introduced the procedure to be followed by course development committees of the Department of Education, but was "primarily devoted" to a discussion of the problem of developing appropriate science material for Industrial Programme students. Despite Mr. Meredith's assertion in his letter to Prof. Cannon, the preliminary work done at the Vocational Course Writing Workshops was not viewed as useful. The meeting report noted :

> A variety of suggestions had been made at the two Vocational Course Writing Workshops in the summer of 1963 and the summer of 1964. It was recognized both by the Department and by those involved in the writing up of these suggestions that a great deal more work was needed in clarifying the nature and content of this course.
>
> The Committee is free to make whatever recommendations it thinks best. It may use in whole or in part, or reject any of the material presently proposed.
> (Industrial Science Course Development Committee [ISCDC], Minutes, Dec. 2, 1964)

The difficulties with the work already completed were recognized by the committee and also by Meredith, despite his assurance to Cannon in the letter requesting that he chair the committee. The ISCDC minutes, written by Meredith, note that with the summer workshop material, "[a] major problem was encountered in the selection of content and the organizing and presenting of this content in such a way that both the content itself and the teaching of

it would accomplish the objectives envisaged" (ISCDC, Minutes, Dec. 2, 1965). The Committee was apparently well aware of the difficulty in selecting "appropriate" material and choosing a viable manner for its presentation. The Committee would ultimately decide to make no use of the work already attempted and, as a committee member recalled, "started from scratch".

At this first meeting, the members discussed the "science-as-content" versus "science-as-process" issue with respect to Industrial Science, but could not arrive at a consensus. Some members argued that developing an understanding of the process of science could be accomplished without specifying precise topics for study; if understanding the process was the important thing, then teachers could select "blocks" of topics to form the course. Other members believed it necessary that certain basic scientific principles must be included which would constitute the core of the course. The issue was not resolved at this initial meeting, and presaged future debates to take place within the Committee.

The meeting concluded with four "tentative guidelines" on which "there appeared to be agreement". These four guidelines are stated in the minutes as follows :

1. The course should be an activity or experience-centred course rather than a reading course or a course largely with demonstrations, notes and text-book study.

2. The course should be based upon good science. There is some danger that studies of this kind involve things other than science. The approach should be through practical applications but these need not contradict or be unrelated to the subject field itself.

3. The course must be flexible because it will be taught to pupils with different backgrounds, with different abilities, taking different specialties, and attending school in different communities.

4. Care should be taken to see that the teaching does not become too sophisticated or rigorous or artificial or unrelated to the total programme of the student. Field trips, demonstrations, use of apparatus of a simple kind, the use of films and film strips, and the conducting of experiments - all of these will have a major part to play in the teaching of the course.
(ISCDC, Minutes, Dec. 2, 1964)

In an attempt to clarify their understanding of an industrial science course, the members agreed to prepare individual "statements of purpose" and brief outlines of topics for the second meeting.

Despite apparent agreement on the four guidelines noted above, future meetings showed that they were not understood by all members in the same fashion. They agreed that Industrial Science had to be "activity or experience-centered", but the realization of this concept was to become subject to much individual interpretation. They also agreed that the course would be based on "good science" and that

"practical applications" need not contradict this. Beyond this general goal, however, there was little conception of how this balance would be achieved in practice. They agreed that the course must remain "flexible" and reiterated the point that it must not become "too sophisticated or rigorous" or "unrelated to the total programme of the student". Yet, it was to become clear that estimates of Industrial Programme students' ability varied greatly among Committee members. Despite this apparent consensus on the four guidelines, the superficial understanding and agreement of this first meeting was to dissolve as the specifics of the course came to be debated.

The committee's second meeting, on January 2, 1965, concentrated on the individual statements concerning the philosophy of the course. It was agreed that Mr. Meredith would attempt to combine the individual statements into one, for further discussion. The committee also decided that the course should be such that it could be taught by an Industrial Education <u>or</u> a Science teacher, and whichever teacher taught Industrial Science 12, there should be consultation with the other. Industrial Science, the committee decided, was to be "both good science and good shop practice" (ISCDC, Minutes, Jan. 12, 1965).

One of the science teachers on the committee remembered the question of who should teach the course as an issue that was never decided, although he personally felt that science teachers should teach it. The ISCDC minutes repeatedly emphasized that it could be taught by a teacher of either speciality, and strongly promoted the idea of team-teaching with both a science and an industrial education teacher. However, few science teachers were to assume responsibility for Industrial Science, and the ideal of team-teaching was seldom, if ever, realized despite the Committee's recommendations.

The anticipated ability-level of Industrial Science students - perhaps the most crucial aspect of the course's development - was also debated at this second meeting but was not resolved to everyone's satisfaction. The minutes reported the discussion in this fashion :

> We must be concerned with the individual abilities of the pupils. There is some danger that we will over-estimate their capacities. (This point caused considerable discussion.) From the classroom point of view, the impression is that we could be over-emphasizing the theory and concepts. On the other hand, we shall also have, presumably, pupils capable of some fairly advanced science work, provided it is practical and closely related to industry. Indeed, some pupils, at least, will need this kind of content.
> (ISCDC, Minutes, Jan. 12, 1965)

The phrase, "some fairly advanced science work, provided it is practical" , points to the dilemma faced by the committee on this issue. It also sums up their ambiguous response to it. From "the classroom point of view", there was concern with the expected level of achievement of the students and the lack of "practical" content. Other members insisted that at least some students would "need this kind of content". The ability-level which could be expected of Industrial Programme students was never agreed upon by the committee members. Each member, in developing the course units for which he was responsible, acted as he thought best based on his estimate of what was appropriate.

The "considerable discussion" on this point, noted in the minutes above, is clearly remembered by the committee members. A science teacher on the committee recalled :

> Dr. Cannon had taught at this school, and he said that he knew what these kids were capable of, that he had seen them get honours in Physics 91. I wouldn't argue, but they weren't here, because it couldn't happen. They couldn't read !
>
> Poor Dr. Seal, we were poles apart. And Dr. Cannon too. The other two were teachers, and they both went along pretty well with me. Not completely, but pretty well.
> (Winteringham Interview, Feb. 2, 1984)

Another committee member also remembered the debate :

Subject: "I can remember one member of the committee who was very much in favour of having everything kept at a very, very simple level."

Int. : "You didn't agree with that."

Subj. : "No, no, I didn't agree with that at all. I know that with good teaching it's astonishing what you can get out of students. It really is astonishing. And I really, after all my life, I still don't know how to inject this into people...."
(Seal Interview, July 22, 1984)

An Industrial Education teacher on the Course Development Committee, who followed Prof. Cannon in teaching Electricity at Vancouver Tech, expressed the opinion that Cannon's experience with Electricity students may have misled him, because "electrical students are generally highly motivated" and cannot be considered typical of Industrial Education students.

> He might have, may I suggest, been coming again with certain pre-conceived ideas of how much of this science these students would be interested in and able to cope with.
> (Kirchner Interview, Aug. 23, 1984)

These differing expectations for Industrial Programme students were never to be fully resolved by the Committee. That the committee felt they were developing a course in which many of the students would be of lower academic ability is shown in a further observation from the minutes of this second meeting; a notebook was considered important because it could enable "the pupil of more limited ability to

learn to follow directions in an orderly fashion and to record conclusions in systematic form and to obtain a feeling of confidence and a sense of success". Yet the extent to which the students' ability was limited was open to wide interpretation. This ambiguity was to colour all future deliberations of the Committee, as well as the operation of Industrial Science in the schools.

Only two of the "statements of purpose" from the second meeting have survived in Prof. Cannon's papers. Mr. Kirchner presented a case, with examples, for avoiding what was termed the "abstract" approach; the properties of <u>materials</u> would be studied, not the properties of <u>matter</u>:

> ...the experiences that the applied approach should be couched in need to be of a very concrete nature, set up in the natural environment of the pupil.... The experiences need to be designed so that the pupil can see a valuable application in the immediate future.
>
> [This approach] would also develop the higher mental processes of analysis, synthesis and evaluation, not in the abstract situation but using the vehicle of the concrete experience that is understandable, familiar, and not awesome or fearful as far as the student is concerned. This student is capable of developing the accomplishments but the region in which the developments takes place must be one in which the student feels secure. (ISCDC, Misc. Papers)

Mr. Seal's proposals concurred with Mr. Kirchner's in attempting to be cognizant of the type of student who would be studying Industrial Science 12

("the students for whom the course is designed are likely to be concrete thinkers rather than abstract thinkers"), yet presented a different philosophy of the course. The first draft of Seal's proposal stated that Industrial Science 12:

> should not be a sporadic investigation of the scientific principles underlying a random choice of industrial processes.
> (ISCDC, Misc. Papers)

The final draft of Seal's proposals softens somewhat, in deleting the sentence above, and stating that the course should provide students:

> with an understanding of scientific principles which are utilized in a practical way in the machines and processes of industry.
>
> In the title, Industrial Science, the word "Science" is the key to the content and the word "Industrial" is the key to the method of teaching.
> (ISCDC, Misc. Papers)

Despite his comments concerning "concrete thinkers", Seal also foresaw pupils of all ability levels studying Industrial Science 12 :

> Pupils of less than average capability will have achieved the objective of the course if they understand the principles without necessarily being able to apply them in quantitative fashion.
>
> Pupils of average or greater than average capability should be able to solve quantitative problems based on the general principles. The ability to apply principles quantitatively will give such pupils increased insight and greater satisfaction.
> (ISCDC, MIsc. Papers)

This second meeting of the Course Development Committee concluded with no common understanding on this point, but with members agreeing to prepare proposals for the content to be covered in the course. Perhaps because of the difficulty in achieving consensus on the overall direction of the course, "[a]t this stage, it was suggested that we should merely identify subject matter content", rather than the details of its presentation:

> In other words, we were attempting to answer the question : What shall we teach in a course in Industrial Science ? Previous outlines have had two weaknesses: the weakness of being too broad, e.g., atomic structure, matter and energy, etc., or the weakness of being too specific, e.g., speed of a motor as being directly proportional to the counter EMF and varies inversely as the field.
> (ISCDC Minutes, Jan.12, 1965)

These outlines were to be distributed in advance to committee members prior to the next meeting on February 10.

In this third meeting, the committee members held in abeyance their discussion on philosophical differences, and concentrated instead on the suggested content outline of the course. The time pressures for completion of the course may have been responsible for this decision, or perhaps it was hoped that through discussion of course content a common ground would emerge. If the latter was the case it was not to be,

as the philosphical issue would arise again when the draft units were reviewed.

The committee tentatively designated ten units of study, some of which were to be considered optional. The units and their authors were determined as follows:

1. Introduction to Science and Technology - Prof.Cannon
2. Concept of Matter and Materials - Mr. Seal
3. Measurement - Prof. Cannon
4. Mechanics - Mr. Phillips
5. Mechanics of Fluids - Mr. Winteringham
6. Heat, Light and Sound - Prof. Cannon
7. Chemistry - Mr. Winteringham
8. Electricity - Mr. Kirchner
9. Metals and Alloys - Mr. Seal
10. Industrial Safety and First Aid - Mr. Kirchner

Brief discussions were held with respect to the direction each Unit should take so that the member responsible would understand the Commitee's general conception of that topic. In the Chemistry Unit, for instance, the Committee decided, following "considerable discussion", that word, as opposed to symbolic, equations would be acceptable where

possible. The members agreed to forward copies of their unit material to the Department for typing by February 24 (just two weeks away) or else prepare it themselves for the March 3, 1965 meeting.

Not surprisingly, not all units were ready for this fourth meeting, but the committee reviewed the draft units presented thus far. It was decided to make the unit on Mechanics Unit 2, and to make Matter and Materials Unit 3 in the final draft. The members, in reviewing this unit on Matter and Materials, determined that "the course would have to be somewhat open-ended, and certain units would be open-ended as well". Apparently this was a response to what some members saw as a heavy reliance on theory in the unit, as the minutes go on to say, "[m]embers were of the opinion that the course would not succeed if a more theoretical approach was considered". Mr. Seal agreed to prepare a second draft of this unit.

Unit 4, now titled Mechanics and Solids, was examined next, with the members recommending a few changes for the next draft. The present Physics 91 course was suggested as a possible source for "optional" or "enrichment" material. Electricity (Unit 8) was reviewed and this too, it was decided, was best left "open-ended" to allow the teacher "to determine the depth and breadth of study which will

best meet the needs of his students". The Unit title was also changed, to Electrical Effects. It was decided that Safety would not be a separate unit, but would be written as a block and referred to in cross references throughout the course. The unit on Metals and Alloys was determined not to be necessary because much of the material was covered in other units. The agenda adopted for the next meeting, planned for March 24, included final approval for the units Matter and Materials, Mechanics, Electrical Effects, and the Safety material.

The fifth meeting actually convened on April 8, 1965, and continued with the review of draft units. The committee decided that a core of certain units, as yet undetermined, would be alloted approximately two-thirds of the course time, with one-third left for optional units. The course was to require one year of 130-135 hours based on one-hour class periods. At this meeting, members also requested copies of the text which would ultimately be selected for the Industrial Science 12 course - Fundamentals of Applied Physics (Olivo & Wayne, 1963).

Throughout the minutes of this fifth meeting are repeated references to the need for more "activities" in the draft units. While a list of concepts or topics was easily assembled, finding "practical"

activities to illustrate them was more troublesome. Of five units reviewed during this meeting, four were viewed as deficient in student activities. In the unit on Mechanics of Solids, "members questioned certain areas [and] Mr. Phillips will add activities and notes for teachers". For the unit on Electrical Effects:

> It was suggested that one or two simple activities could be suggested for the unit and it will be complete and ready for printing. The specific direction would assist teachers in determining the way the material could be handled.

The material on Safety and First Aid:

> will perhaps require amplification in the form of an appendix suggesting ways the material might be treated.

On Unit 5, Mechanics of Solids :

> It was suggested that more student centred activities be included.

The unit on Matter and Materials was one of the few units felt to be sufficient in terms of student activities and direction for teachers :

> Members spent considerable time studying the activities suggested for this unit. Mr. Seal was commended for his excellent presentation of this material.
> (ISCDC, Minutes, Apr. 8, 1965)

Units which still had not been developed were listed in the minutes. These included, with author,

Unit I - Introduction - Prof. Cannon

Unit II - Measurement - Prof. Cannon

Unit VI - Heat, Light and Sound - Prof. Cannon

Unit VII - Chemistry - Mr. Winteringham

Unit IX - Metals and Alloys - Mr. Seal

The agenda for the sixth meeting on April 25 included the editing of these units which, "if possible", were to be sent to members prior to the meeting. It was concluded that the Curriculum Guide for Industrial Science 12 would be ready for presentation to the Director of Curriculum after three further meetings.

At the April 25 meeting, Prof. Cannon submitted an oral report as his proposal for the Introduction to Industrial Science unit; he agreed to prepare written material for the next meeting. A written draft of his unit on Measurement was presented for members' perusal. The committee held some concerns about this unit and:

> [c]onsiderable time was devoted to this material by Committee members. It was agreed that this unit be expanded and submitted for committee review at the next meeting. A reorganization of portions of this unit was also agreed upon, and will be considered in the rewrite.
> (ISCDC, Minutes, April 25, 1965)

The committee reviewed the other units and summarized their progress to date, as shown below :

Unit 1 - Introduction - Draft copy to be ready for May 10

Unit 2 - Measurement - Final copy to be ready for May 10

Unit 3 - Mechanics of Solids - Unit completed, has no appendix

Unit 4 - Matter and Materials - Unit and appendix completed

Unit 5 - Mechanics of Fluids - Unit and appendix completed

Unit 6 - Heat, Light and Sound - Draft copy for May 10

Unit 7 - Chemistry - Draft copy for May 10

Unit 8 - Electrical Effects - Unit Completed - Appendix to come on May 10

Unit 9 - Safety and First Aid - Unit completed - Appendix to come on May 10

(ISCDC, Minutes, Apr. 25, 1965)

The seventh meeting - the last for which we have minutes - was held May 10, 1965. Prof. Cannon gave a report on a conference he had recently attended at M.I.T. (a "meeting of Scientists in Boston", the minutes noted), which had advocated a comprehensive plan for technical, vocational and occupational

education in the United States. This conference, according to the summary provided the committee by Prof. Cannon, viewed the "immediate problem" as providing "for the non-employable group in society" (ISCDC, Minutes, May 10, 1965). Materials were to be made available during the summer of 1965 which "may prove of assistance to teachers of Industrial Science 12".

The draft units on Electrical Effects and Chemistry, the only unfinalized units ready for this meeting, were reviewed and minor changes recommended, with further additions made to the "activities" area.

The suggested time allotment for Industrial Science 12 was also established at this meeting. Based on a year of 135 hours, the course would have the following required units :

Unit 1 - Introduction - 10 hours

Unit 2 - Measurement - 10 hours

Unit 3 - Mechanics of Solids - 30 hours

Unit 4 - Matter and Materials - 20 hours

Unit 5 - Mechanics of Fluids - 30 hours

The remaining units would be optional, "for the teacher to judiciously select according to interests, needs and abilities of the class". These units, for a total of 35 hours, would include:

Unit 6 - Heat, Light and Sound

Unit 7 - Chemistry

Unit 8 - Electrical Effects

It was confirmed that Safety and First Aid, although it continued to be spoken of as a unit, would be taught throughout the year.

Having established the content of the course, the Course Development Committee then discussed the possibility of Industrial Science becoming a two-year programme "because of the breadth and depth of the material prepared, studied, and reviewed...." The committee suggestion was that Applied Mathematics 11 and General Business 12 - both compulsory courses, or Programme Constants, in the Industrial Programme and both "mathematical in nature" - could be combined, thus freeing the time for an Industrial Science course in Grade XI. Some mathematics "in the context of science" would then be added to the Industrial Science 11 course. Mr. Seal remembers the recommendation for a two-year course, because "it was obviously impossible to get through all this in one year.... Quite impossible". This recommendation was not acted upon by the Department of Education.

The meeting concluded with another listing of progress to date, the last for which we have a record:

Units Completed:

Unit 3 - Mechanics of Solids

Unit 4 - Matter and Materials

Unit 5 - Mechanics of Fluids

Unit 7 - Chemistry

Unit 8 - Electrical Effects

Unit 9 - Safety and First Aid

Units Partially Completed:

Unit 2 - Measurement

(Final approval to be given at meeting of May 25,1965)

Units to be Prepared:

Unit 1 - Introduction

Unit 6 - Heat. Light and Sound

(Draft copies will be available for study on May 25, 1965)

The last meeting of the Course Development Committee, May 25, 1965, was to finalize the material for the Curriculum Guide. As shown in the progress report above, one unit was still to be given final approval and two units had not yet been written; these

units were the three to be prepared by Prof. Cannon. In interviews with the committee members, twenty years after its operation, they expressed frustration at the Chairman's performance. Prof. Cannon was very busy and "in many cases he would be in and out quickly". Another member recalled that the Chairman was "very, very busy at the time and we had many meetings at which he did not appear" (Seal Interview). One committee member recalled that "the seriousness didn't appear to be there" :

> We were disappointed in the manner in which it was chaired. We were disappointed in the follow-up and materials. Harry Cannon was the last to put in his materials. In fact, I don't think that we ever did see some of his material. And that was annoying to members, most annoying.... It wasn't a well-run revision committee.
> (Kirchner Interview, 1984)

The provincial curriculum guide for Industrial Science 12 was issued in 1965, although the course itself was not offered until September, 1966. The guide outlined the Industrial Programme of the Senior Vocational Programme and its three specialty areas of Construction, Mechanics, and Electricity. Industrial Science 12 was a required course in the Construction and Mechanics specialties, but, in the Electricity specialty, the Drafting 12 course could be substituted for Industrial Science 12, probably on the assumption

that electricity students would likely have a sufficient background in science.

The stated objective of the Industrial Programme was :

> to provide the initial preparation for successful employment in a range of industrial occupations and to develop those qualities of character and personality that make for good citizenship.
> (BCDE, Industrial Power, Industrial Science 1965, p. 4)

It is not recorded who had responsibility for finalizing the curriculum guide, although we may assume that Prof. Cannon, as Chairman, presented it to the Division of Curriculum for approval. The introduction to the course outline echoed many of the statements found in the minutes of the Course Development Committee. In stating that it is "not intended that theory and concepts be over emphasized", the preamble to the guide went on to say :

> [o]n the other hand, there are some pupils capable of some advanced science work, providing it is practical and closely related to industry.
> (p. 19)

The curriculum guide noted that the course "may be taught by either an industrial education or a science teacher" and repeated that the course should incorporate "good science and good shop practice" (p. 19).

The four specific objectives listed in the curriculum guide for Industrial Science 12 present an interesting facet to this study of the development of Industrial Science 12. These four objectives were identical to four of the five objectives listed for the Science, Technology and Trades Science programme in Ontario (Ontario, Department of Education, Science, 1964, p. 15). (3) These specific objectives were not the only items duplicated from the Ontario document. Except for the bracketed [] sections indicated, the following paragraph on lab instruction was identical in each:

> [To realize these objectives laboratory] instruction should be organized to permit pupils to work individually or in small groups. The number of pupils working together will depend, to some extent, on the size of the class, [(ideally, twenty-four pupils, with not more than thirty pupils),] on the equipment available, and on the topics studied. For certain topics, where the order in which the experiments undertaken is not fixed, the experiments may be carried on simultaneously. (BCDE, p. 19; ODE, p. 15)

At least two other paragraphs in the British Columbia Industrial Science 12 curriculum guide were duplicated from the Ontario guide. (4)

Despite the British Columbia curriculum guide's suggestion that the course could be taught by either a science teacher or an industrial education teacher, it

went on to imply that the Industrial Science 12 instructor might have trouble in evaluating the lab ("log") book. It suggested that "the head of the science department, the principal, or some other educational authority assist in the evaluation of the log book" (p. 21). Despite the guide's assertion with respect to who would teach the course, the assumption appears to have been made that Industrial Science 12 was an Industrial Education course to be taught by Industrial Education teachers.

The Unit Outlines in the guide corresponded to those of the Course Development Committee, noted above. Unit 4 on Matter and Materials - for which Prof. Seal had been complimented by the Committee- provided detailed instruction for 18 experiments on such topics as the shear strength of wood, nailing patterns for optimum resistance to lateral load, comparison of lubricants, et cetera. The other Units were presented in various columnar, or modified columnar, formats, usually with the headings of Contents, Activities, and Notes. For the most part, these other Units gave only skeletal outlines of the lab activities to be performed, despite the Committee's efforts to emphasize activities.

The Course Development Committee met its deadline to produce a curriculum guide, but its

internal debate presaged much of the reaction Industrial Science 12 was to receive in the schools. The expectations held for industrial education students, the balance between the "theoretical" and the "practical", the balance between "good shop and good science", were still to be contentious issues for teachers. As will be discussed in Chapter 7, Committee members themselves were not pleased with the compromises made under the pressures of a deadline, and did not hold high expectations for the success of Industrial Science 12.

1. In 1971, Mr. Hancock responded to the questionnaire circulated by the Technical Advisors (see note #10, Chapter 6) with a discussion of the important issues respecting Industrial Science 12 and his personal course outline. Two-thirds of Mr. Hancock's course dealt with Machines & Controls, comprised of five units : Applied Mechanics, Thermodynamics, Electromechanics, Electrical Power, and Industrial Electronics. The 32 concepts to be covered in the Applied Mechanics unit included : Bow's notation for graphical solutions, centre of gravity of a system of particles, graphical solution of a concurrent coplanar force system in equilibrium, resultant of a noncurrent coplanar force system, radius of gyration, moment of inertia of composite areas, and rectilinear motion of a particle. As Mr. Hancock explained, "[t]he problem facing the student is the logical approach to principles, versus his ability to understand through empiricism."

2. Fred Hancock applied for membership on this committee, in response to a BCTF request for nominees to submit to the department, but was not selected. It is not clear whether this was a decision of the Department or the BCTF, which would first screen nominees. The Supervisor of Industrial Education with The Vancouver School Board at that time, when interviewed about this matter, replied :

> You know why [he was not selected] ? He was so set in his ways. He would never have adjusted. He couldn't adjust.
> (Cutherbertson Interview, July 4, 1984)

Harold Kirchner, who served on the Course Development Committee, remembered that he had not applied to join the committee but instead was contacted by the Department.

3. J.R. Meredith had forwarded this publication to Prof. Cannon in a November 25, 1964 letter, soon after Cannon's appointment as Chairman.

The only missing objective was "to arouse curiosity regarding natural objects and phenomena, in order to develop an understanding of the elementary facts of nature".

4. One paragraph stated:

> Teachers may find it necessary to set up certain pieces of apparatus as permanent equipment to be in readiness for frequent use. Whenever possible, other equipment used should be assembled by the pupils.

The Ontario curriculum guide stated that "[s]uitable text-books, as well as books of reference, should be provided in laboratories and in classrooms where science is studied". The British Columbia curriculum guide stated that "[a] suitable text-book, as well as books of reference, <u>may</u> prove valuable" [emphasis added]. They both continued :

> Illustrative material, such as pamphlets, charts, process diagrams, and sample products should also be procured and filed for ready reference. Pupils should be encouraged to use these books and materials [;] to secure additional information on the topics studied, [;] to understand the practical application of scientific principles [;] and to realize their value.

Chapter 6

Industrial Science 12 in the Schools

Industrial Science 12 was introduced in British Columbia secondary schools in 1966 and difficulties with the course were evident immediately. Industrial education teachers, tradesmen for the most part, had little expertise in, or sympathy with, the new course. Students viewed the course as a thinly-veiled science course and not the expected industrial education offering. Problems in acquiring facilities and equipment exacerbated the teaching situation. For the next five years, the various parties involved in Industrial Education - the BCSTA, Department of Education, Technical Advisors - struggled to provide the support necessary to make the course viable.

The only attempt at pre-implementation inservice for Industrial Science 12 teachers was to have taken place during a larger inservice session concerning all the new Senior Vocational Programme courses. The Technical and Vocational Division of the Department of Education attempted to provide some inservice workshops on the new courses, including Industrial Science 12, during the summer of 1966, "after consultation" with the BCTF and BCSTA. (1)

These Senior Vocational workshops, including Industrial Science 12, were held at Vancouver Technical Senior Secondary School, July 11 - 22, 1966. Notification of the workshop was circulated to schools in a May 24 flyer from the BCTF, which noted that no fees would be charged for the course (which apparently was usually the case for BCTF-sponsored workshops) and that District Superintendents had been asked by the Department of Education "to encourage school boards to assist with out-of-pocket expenses incurred by teachers." As the workshops dealt with the Industrial Programme, school principals were asked only to bring the circular to the attention of Industrial Programme teachers; no mention was made of the possibility that science teachers might be teaching the course. Scheduling of the workshop in mid-July, even without a fee being charged, would have insured that only the most professionally-motivated of teachers would attend. It is unlikely that science teachers would even have been aware of the Industrial Science 12 sessions.

A one-page report of the Industrial Science 12 workshop found in the BCSTA Archives summarized the session. The report expressed the participants' view that "a course of this nature was necessary" and that it could be a "strong" course in the Industrial

Programme. It warned about permitting the course to become a "watered-down" science course, and suggested that to "keep the course at a high level there must be cooperation [emphasis in original] between the science and industrial education departments." Team-teaching was suggested as a valuable approach for a course of this nature. This echoed the aspirations for the course entertained by the Course Development Committee but, as noted above, it is unlikely that information on the workshop ever reached science teachers.

The report did express concern about the amount of material to cover in Industrial Science 12 and, despite suggestions for additions, it was determined that no more should be added "until the teachers become more familiar with the present material." Equipment lists were discussed and "many phone calls were made in an attempt" to locate supplies and materials. It was the participants' opinion that additional workshops would be necessary "when equipment becomes available so that teachers can obtain actual practice with equipment." (2) The report concluded by recommending that some means be established whereby teachers of Industrial Science 12 would be able to help each other during the school year. The hope was expressed that the Industrial

Education Inspectors could handle this "clearing house" function.

Despite the workshops (we have no information on the number attending), teachers apparently experienced difficulties with the course during 1966/67, its introductory year. By February, the BCSTA Executive had decided to offer a workshop in Industrial Science 12 on March 31, following the BCSTA Convention. This decision was apparently "[i]n response to requests from members" (BCSTA Newsletter, February, 1967). The Executive hoped that the session would overcome some of the shortcomings of the previous summer's workshop by providing practical use of the lab test equipment. A sense of teachers' difficulties is felt in the Executive's decision that an attempt was also to be made "to get together some of the men who laid out the course and have them give us some ideas of how they expected the course to be taught" (BCSTA, Minutes, February 3, 1967).

Along with this lack of understanding, the shortage of equipment continued to be a problem and meetings were held during the spring between Department of Education and BCTF/BCSTA officials to discuss this issue. The Coordinator of Industrial Education, Joseph Jupp, who was responsible for coordinating the use of TVTA funds, and Bill Allester

of the BCTF, attended a BCSTA Executive meeting in an attempt "to resolve problems of equipment for Industrial Science 12." In May, Mr. Jupp agreed to try to have an overhead projector added to the Industrial Science 12 equipment list, but noted that in using the TVTA funds it was necessary to work to specific lists of equipment.

While waiting for a provincial response to teachers' problems with the course, regional groups began to tackle the issue. Industrial education teachers of the Cowichan district on Vancouver Island held a workshop at Duncan in April of 1967 at which they suggested that a committee be struck to develop a "concrete curriculum" for Industrial Science 12. In a letter to the president of the BCSTA expressing teachers' dissatisfaction with the Department of Education's curriculum guide, a teacher from the Duncan workshop wrote :

> After having the opportunity to take[sic] with the men concerned about Industrial Science 12 several facts emerged. The men in this province are well trained to teach the practical skills. Now that the change to technology has taken place it is causing real problems. There is no precedent in this teaching area and no attempt has been made to provide core materials to permit the first year to be taught without endless hours of research. In common with many others I have responsibilities to my family as well as my profession.
>
> The solution as I see it is to have writing teams organized for this summer, hired by the Department of Education <u>NOW</u>. The course is

> already broken up into related sections. Mr. Jupp has already concluded a survey of talent. I am sure Inspectors' reports will point out those who are having success in this field. These writing teams should be paid 1 weeks[sic] salary for their preparatory work. A few days[sic] group discussion would clarify the aims and then smaller groups could co-ordinate their prepatory units into a manual for each section. The last few days are necessary to co-relate[sic] material. In all 10 men or 12 could write the initial units.
>
> Development must not stop here for these units are only introductory and the need is for individual pursuit of a particular study field. Initially 2 weeks together with salary for 3 weeks to cover writing the units should produce significant results.
>
> The above is a brief outline of how to start the ball rolling in a purposeful manner. (BCSTA Newsletter, May 1967, #2)

The writer's suggestions, written eight months after the implementation of Industrial Science 12, amount almost to a plea to rewrite the course. Noting that there was no precedent for such a course, he states that "endless hours of reasearch" are necessary because of deficiencies in the curriculum guide. The aims of the course were viewed as needing clarification and even with new units developed, that work would only be "introductory".

The idea of employing writers to further develop the Industrial Science 12 course was discussed by the BCSTA Executive at a special meeting with Mr. Jupp, at which the BCTF General Secretary, Mr. Charlie Ovans, was also present. Mr. Jupp informed the Executive that the Department of Education had agreed to

sponsor a workshop during the summer, which would be attended by John Meredith, the Director of Curriculum. At that time, this suggestion to employ further writing teams for Industrial Science 12 would "receive consideration" (BCSTA Newsletter, May 1, 1967, #1).

The President of the BCSTA, Ross Regan, apparently unwilling to wait for the summer 1967 workshop, felt that an independent research study into the Industrial Science and Industrial Power courses was necessary. A proposal advocating this, dated May 4, 1967, was forwarded to the Laboratory for Educational Advancement, Research and Needs (LEARN)- an educational research group funded by Vancouver Island School Boards, teacher associations, and the University of Victoria, and centred at that university. Mr. Regan's proposal is interesting in that it implies strong support for the concept of Industrial Science, while at the same time it delineated many of the difficulties being experienced in the field :

Proposal for Research Study Programme in Area of Industrial Science and Industrial Power Courses.

Submitted by Ross Regan,
President, B.C. Shop Teachers' Assn.
May 4, 1967

Objectives:

1. To coordinate aspects of these courses with industrial needs and modern trends.

2. To prove the applications of a practical science course.

3. To further develop the integration of a practical subject with the subjects of English, Mathematics, Physics and other industrial education courses.

4. To prove the need for a resource course related to a wide area of industrial applications which will benefit most pupils.

5. To illustrate the importance of study reports and factual outlines of experiments and procedures.

Reasons for Suggesting These Courses:

1. Equipment costs have been largely met via Federal and Provincial grants to vocational education.

2. The new courses have not yet been proven in application; there is a wide discrepancy in interpretation of the curriculum guides.

3. There is a major need for a successful approach to the integration of resources in industry and the schools and the application of the respective concepts in this field of study.

4. There should be convenient coordination of

industrial personnel and use of equipment required for effective learning.

5. There is need for suitable resource material as texts and work books which may eventually be used in all schools. Individuals involved lack the time and experience required to develop the course.

6. There is ample opportunity to coordinate resources of teachers from other subject areas and develop a team approach to teaching the subjects.

7. There is opportunity to further study how pupils learn in an area which combines theory and practice.

8. The need exists for more adequate preparation of pupil background in practical areas for those entering industry upon graduation.

9. It is essential to develop status of this discipline in the eyes of parents and industry for acceptance as a suitable alternative to university entrance on the academic specialties. This would provide an opportunity to adopt a critical approach to the introduction of a programme which could meet the needs of a large group who have thus far been ignored in adapting courses to their special needs.

Funds used for:

1. Research into the best means of teaching the various sections of these courses.

2. The expenses incurred in the use of resource persons.

3. In-service training of teachers involved in these courses.

4. Experimental materials necessary to prove the best instructional process, e.g. films, slides, projectuals.

5. Writing of adequate resource material, workbook and curriculum guide.

6. Development of a job experience plan for pupils in this field.

7. Rental of specific equipment as required.

8. Flexible accommodation planning - possible student construction.

9. Hiring of additional staff to ensure reasonable class sizes (Dr. H. Cannon, Chairman of course writing team suggested class size of 16.)

10. Transportation.

Industry to supply :

1. Equipment useful as instructional aids.

2. Advisors and resource persons.

3. Guides for field trips.

4. Visual communication aids as slides, films, pictures, projectuals.

5. Sample materials and new products.

6. Current information and statistics on use of materials and equipment which is being used and tested in these courses.
(BCSTA, Misc. Papers)

Mr. Regan's support for the concept of Industrial Science and Industrial Power is apparent in this document, notably in numbers 2 and 4 ("to prove...") of the objectives. This proposal, written nine months after the introduction of Industrial Science 12, also

highlights some of the problem areas which were to afflict the course through the next few years : the lack of printed resources, the varied interpretations of the curriculum guide, the absence of coordination and team-teaching with other disciplines, the confusion as to "the best means of teaching", the unfamiliarity/unavailability of equipment, and the large class sizes.

Interviewed for this study, Mr. Regan noted that the proposal "was my own submission; it was not something that came through the BCSTA." As President of the BCSTA, he had received so many complaints from members that he felt this might have been a possible approach to improving the course. The research centre, LEARN, "paid no attention whatsoever" to the proposal, and Mr. Regan could not recall "if they even responded."

In an effort to respond to the problems of Industrial Science 12, the Department of Education had planned the summer workshops which Mr. Jupp had mentioned to the BCSTA Executive in April. However, as with the previous year, these workshops were to deal with many of the courses in the Industrial Programme, not only Industrial Science 12. The workshops were to be held at Kelowna in two different sessions. As with the previous years' workshops, the

Department of Education emphasized that no fees would be charged. Industrial Science, Industrial Power, and the Junior Programme sessions were to be held July 10 - 21 inclusive, and the circular announcing the workshops indicated that science teachers were encouraged to attend. However, Industrial Science and the Junior Programme were half-day courses, to be taken concurrently with the Industrial Power sessions, an arrangement not likely to appeal to science teachers.

The objectives of the workshop seemed more suited to preliminary work rather than to courses which had already been implemented for at least one year:

> 1. To develop the particular skills required to teach the courses using the new equipment.
>
> 2. To examine and establish current methods in the presentation of materials to the students.
>
> 3. To develop an approach to the new programmes within the terms of a resource course.
>
> 4. To interpret the objectives of the Industrial Programme.
> (BCSTA, Newsletter, May 1, 1967)

Despite the apparent need for such workshops, the Kelowna sessions had to be cancelled due to a lack of applicants; the pre-registration received by the Department of Education for Industrial Science numbered only eight teachers (AR, 1966/67, p. F86). Again, the mid-July scheduling might be assumed to be

at least partially responsible for the low response. The Department of Education's Annual Report stated that in lieu of workshops, teaching "suggestions" would be complied and distributed. (3) It was left ambiguous whether this compilation and distribution would be undertaken by the Department of Education, as the June 1967 Annual Report of the BCSTA indicated that the Executive had approved a plan "to further develop and provide learning materials for Industrial Power and Industrial Science courses up to $200."

The BCSTA began an intensive year of work on Industrial Science 12 in 1967/68, its second year in the schools. (4) The main concern of the BCSTA was the absence of resource material which could provide direction for individual teachers. The October Newsletter announced plans to do a survey with respect to Industrial Science 12 and to determine the "needs and possible costs to develop resource material and manual." This newsletter included a list of 58 Industrial Science teachers and asked those whose names were not on the list to notify the Chairman of the Industrial Science Committee, Mr. Angus Fraser. Although this newsletter was circulated only to BCSTA members, the list of 58 teachers did include a few science teachers who were teaching Industrial Science 12.

Mr. Fraser reported to the BCSTA Executive at its October 20 meeting, at which time they authorized funding of up to $100. to set up an "Industrial Science resource group". The minutes noted that :

> [Mr. Fraser] has defined his objectives and is circularizing all Industrial Science teachers asking what help they can offer other teachers in the way of innovations and resource materials. After these questionnaires are returned he intends calling together a small group of interested teachers to sort, assemble and distribute that which the group considers pertinent.
> (BCSTA Minutes, October 20, 1967)

The November Newsletter notified BCSTA members of the establishment of this committee and, in encouraging responses, noted that "[e]verybody is having trouble with part of the Industrial Science course." It also announced that the Curriculum Directors of the BCTF had pledged financial support for the distribution of material received by the committee.

The Industrial Science Committee directed a letter and survey instrument to teachers who had taught the course during its first year, 1966/67. The recipients who were no longer teaching Industrial Science were asked to pass the survey on to the present teacher, "be he Science or Industrial Education". The primary purpose of the survey was to gather curriculum materials which could be made

available to all teachers. Mr. Fraser's letter expressed the BCSTA's pragmatic view of the Industrial Science situation:

> The intention of this survey is to accept the Industrial Science course in its present form and working within this framework to provide the assistance necessary to the teacher to offer an interesting and comprehensive program. Regardless of whether changes in the course are needed or not Industrial Science will continue in its present form for at least two or three more years. With this in mind any request for criticisms have been omitted....
>
> For this program to work, everyone's cooperation is needed. No matter how small your contribution is, it will be appreciated. We can only get help if we help ourselves. (Letter, November 3, 1967)

Implicit in Mr. Fraser's comments is that many teachers felt a major change was required in Industrial Science 12 - "... to accept ... in its present form"; "...whether changes are needed or not [it] will continue for at least two or three more years". He explicitly points out that criticism is not requested.

This negative reaction by teachers to Industrial Science 12 became an issue at the BCSTA Fall Annual General Meeting. After reporting on the work of the Industrial Science Committee, the minutes commented :

> Some teachers feel that the course cannot succeed and are taking a completely negative view to "trying to prolong its life". Gus [Mr. Fraser], fortunately has taken the positive view. The course is being offered, most teachers are having problems of one kind or

> another, so lets [sic] make the course work through internal co-operation.
> (BCSTA Minutes, November 24, 1967, p. 2)

The response to the BCSTA Industrial Science Committee's survey was very poor. Mr. Fraser sent a follow-up letter on January 5, 1968, which reported that only 15 responses had been received of 80 mailed, and that the committee would meet on January 27 to compile the material received. There is no information on how many responses were finally received by the committee, but twenty teachers (four from Vancouver Island, three from the Interior, and the rest from the Lower Mainland) attended the January 27 meeting at the BCTF building. The results of this session were reported in the February Newsletter. (5)

The newsletter report of the meeting noted that "almost all of the teachers present felt strongly that the course was good and could be made interesting and meaningful". The group also returned to the important question of who should teach the course, and concluded that a team approach of science and industrial education teachers "would be the best way to handle" Industrial Science. The problems concerning equipment were discussed and a motion, directed to schools and districts, was passed which stated that Industrial Science should not be offered unless "minimum equipment and facilities" were provided.

The choice of a textbook was also discussed, and the teachers present gave a lukewarm endorsement to the Department of Education's suggestion (Olivo & Wayne, 1962) as an interim measure, but attached the condition "that the book be removed from the textbook list after a suitable replacement has been prepared by a committee of industrial science teachers and industrial consultants." (6)

The BCSTA Executive held a special meeting on January 26 - the day prior to the Industrial Science Committee meeting - with the Coordinator of Industrial Education, Mr. Jupp, and the two Technical Advisors, Mr. Smith and Mr. Tidmarsh. (7) Mr. Jupp informed the Executive that the Department of Education had commissioned the writing of a correspondence course for Industrial Science 12, which would also be "an excellent guide to assist new teachers to the course." He noted that the two-man team which would write the course was comprised of "a Science man and an Industrial Education man" and again emphasized the importance of a team-teaching approach. At this meeting, Mr. Jupp also stated one of the hitherto unspoken assumptions of the Industrial Science 12 course:

> The boy on the industrial Programme who possibly can not handle an academic science

> course is able to get credit for a science on his transcript.
> (BCSTA, Minutes, January 26, 1968, p.1)

However laudable this intention may have been, it was doomed to failure when no post-secondary institution in the province, including the BC Institute of Technology, would agree to accept Industrial Science 12 as a science credit.

As a result of their January 27 meeting, the Industrial Science Committee (now called the Industrial Science Resource Committee) developed a second survey; this one to determine the adequacy of equipment and resources in the schools for Industrial Science. (8)

The results, made available in a March 22, 1968 report, showed a marked dissatisfaction with the present facilities and equipment. The return rate for the questionnaire was 64 % (54 of 84 responded), and 76 % of those responses indicated facilities which were partially, or totally, unequipped. In response to the question, "Do you feel you have sufficient supplies and equipment and adequate facilities to teach a meaningfull [sic] course ?", only 22 of the 54 responses answered in the affirmative. Comments ranged from complete satisfaction :

> [w]e have been afforded complete freedom to get the facilities for the course. No complaints at all. New lab provided.

to the despairing :

> these classes are being taught in a Home Ec. Sewing room and a Senior Wood shop - equipment borrowed from Science on a period basis. (BCSTA, Misc. Papers)

The committee's report concluded only that more concern must be shown by both local and provincial authorities in establishing proper labs for Industrial Science 12; no questions were raised about the use of TVTA funds for Industrial Science, as opposed to traditional industrial education, facilities.

The results of this equipment/facilities survey were brought to the members at the Spring General Meeting of the BCSTA on March 22. The meeting recommended wide distribution of the results and that notification be sent to the Department of Education. The minutes also noted "serious discussion" about dropping the course where facilities were not available, and it was reported that one (unidentified) school was not going to offer Industrial Science 12 in the upcoming year. (9) After this discussion, the following motion was carried by the assembly :

> that no Industrial Education teacher accept a position to teach Industrial Science where adequate facilities and equipment do not exist. (BCSTA, Minutes, March 22, 1968, p.1)

The problems of lack of equipment and resource material continued, and the BCSTA Executive continued to meet with the Coordinator of Industrial Education

and the Technical Advisors in an effort to resolve the problems. The Technical Advisors' role changed, and they began their attempt to provide assistance to Industrial Science teachers. The major complaint of industrial education teachers who taught the course- the lack of direction for them with respect to the lab activities which were to have been the heart of the course - prompted the Technical Advisors to publish a lab manual in 1969. This manual had been developed by a teacher, Gary Mott, who was a strong advocate of the course and operated what was considered to be one of the best Industrial Science 12 courses in the province. Mott's manual offered detailed instructions, with photographs, of various lab experiments which provided much-needed direction for many of the Industrial Science 12 teachers. Its distribution by the Technical Advisors marked the beginning of an extended effort on their part to improve the course.

That major difficulties were being experienced with Industrial Science 12 was made obvious in the Department of Education's Annual Reports for 1969/70 and 1970/71. Both reports took the extremely unusual step of mentioning this course specifically and discussing its difficulties. Those comments corresponded with the beginning of the curriculum

efforts by the Technical Advisors. In the 1969/70 AR, it was noted that "considerable study" had been undertaken with a view to holding zone workshops throughout the province. (The previous attempts at workshops had been provincial in scope.) The next year's AR (1970/71), however, expressed some exasperation with the difficulties the course was in and indirectly questioned the effort being made by schools and teachers to improve Industrial Science 12:

> It has become obvious the Industrial Science 12 course introduced in the Senior Secondary program in 1965 was receiving little or no attention in some schools where as [sic] in a very few schools a determined effort was being made to offer an effective course.
> (AR, 1970/71, p. C68)

The major efforts of the BCSTA to further the implementation of Industrial Science 12 subsided after the first three years. The BCSTA archives show that it ceased to be a major topic of concern for the association and the course seldom was mentioned at its meetings. Apparently, some schools and individual teachers had reached an accomodation with the course : either through one teacher's experience with the course over the previous three years, or the school's willingness to prevaricate when reporting marks to the Department (see note 9). The Association may also have felt that it had accomplished all it could with

respect to Industrial Science 12 and saw the need to turn its attention to the many other aspects of the Industrial Programme. The BCSTA's gradual withdrawal from active involvment with Industrial Science 12 cannot be interpreted as meaning that the course was problem-free. The Department of Education, through its Technical Advisors, took over the leading role in Industrial Science 12 trouble-shooting.

The two Technical Advisors devoted much of 1971 to Industrial Science 12. Their Departmental newsletter, ie [sic], announced that they and the Coordinator of Industrial Education intended "to give prior attention [sic] during the period of January to June, 1971, to the Industrial Science problems." Their stated aims in doing this reflect many of the same objectives which the Course Development Committee, various workshops, and the BCSTA had expressed over the previous few years :

> 1. to determine and specify a valid core for Industrial Science.
>
> 2. to produce an essential list of equipment to match that core.
>
> 3. to compile and distribute a book of Industrial Science resource material.
>
> 4. to demonstrate useful Industrial Science units at District Workshops.
>
> 5. to consider ways and means of scheduling Industrial Science in small schools or with small enrollments.
> (ie, 71 (1) n.p.)

This first issue of ie announced a survey which was to investigate the problem areas of the course. This survey would provide teachers with the opportunity to decide on the curriculum areas which were felt to be important and "to pan the units that seem inappropriate" so that the Technical Advisors could recommend "a more valid content for Industrial Science". They noted that since the 1965 reorganization, "[e]asily the greatest concern" in Industrial Education had been "in the areas of Industrial Science and Industrial Power courses." The instructors of these courses "invariably require[d] more positive direction." They also required "at least appropriate facilities and some adequate equipment." In a telling phrase, used to describe its place within the Industrial Education programme, the Technical Advisors referred to Industrial Science 12 as "truly the orphan since its inception" (ie, 71 {1}, n.p.).

The Technical Advisors noted three main areas of difficulty for Industrial Science 12 instructors. The "newness" of the course and lack of a precedent, provided the "initial roadblock". Teachers, without experience in the field themselves, could not find direction in other jurisdictions because of the unique nature of the courses. A second major difficulty

noted by the Technical Advisors was that Industrial Science was rarely the major area of responsibility of the teacher, who would have a major subject area and accompanying shop in a trades area. Industrial Science, consequently, could not receive "a justifiable degree of planning and preparation." (The notion of science teachers, or a team of teachers, instructing the course was not mentioned.) Finally, Industrial Science would usually be given the last consideration in time-tabling and use of facilities/equipment, often being "crowded into a facility set up and used for some other major subject." The Advisors also praised those who had established effective course "[a]gainst all the odds."

As a result of the Technical Advisors' efforts, workshops in Industrial Science were finally held throughout the province in the Spring of 1971, with 154 teachers taking part (AR, 1970/71, p. C68). The 1971/72 AR reported that, among the topics discussed, was "the future of industrial science" (p. D30)- apparently still a matter for debate. At these workshops, the results of the Technical Advisors' survey were available. (10) As a result of these workshops, a large collection of resource material developed by teachers in the field (which the BCSTA Industrial Science Resource Committee had attempted in

1968) was assembled and made available to teachers through the Technical Advisors' office.

Although the Technical Advisors were making efforts to improve the Industrial Science 12 course at this time, the Department of Education had already decided that the province's entire Industrial Education programme, reorganized just five years before, was in need of review. In September of 1970, the Department of Education sought nominees to serve on an Industrial Education Advisory Committee. The Department's Director of Curriculum at that time, W.B. Naylor, informed the BCTF that the committee's purpose would be to "evaluate, not revise" the Industrial Education programme, but that "the recommendations made by the committee might indeed result in the establishment of other committees to undertake specific course revisions" (BCTF, Pro.D., bulletin, n.d.). The 1971/72 AR announced that the Industrial Education Advisory Committee would review all Industrial Education courses and recommend "necessary improvement to meet the current educational objectives" (p. D29).

Industrial Science 12 continued in the schools throughout the period of the Industrial Education Advisory Committee's deliberations, but the Committee soon determined that changes to the course were

necessary. In the Autumn of 1972, the Coordinator of Industrial Education wrote to the BCSTA concerning workshops at which the "format of proposed new courses to replace Industrial Power and Industrial Science, i.e., Technology 11 and 12" was to be discussed (BCSTA, Newsletter, Dec. 7, 1972). (The "Technology" appellation had first been suggested for Industrial Science and Industrial Power by a BCSTA member, G.O. Ballard, early in 1969.) This decision to replace Industrial Science 12 was made just six years after its introduction in September, 1966.

This complete reorganization of the Industrial programme was not completed until 1976. The Department of Education's description of the new Technology 11 and 12 courses stated that they were to "introduce a new approach to the previous Industrial Power and Industrial Science courses" (Industrial Education, 1977, p. 167). In line with the Department of Education's new philosophy of local interpretation of courses, there was only a brief, four-page discussion of Technology in the Industrial Education Curriculum Guide (1977). This discussion pointed out that the courses could be "as diversified as the teachers' experiences" (p.169); teachers were "expected to develop their own particular courses" (p.167). In contrast with the approach of ten years

earlier, "[t]he development of each course [in grades 11 and 12] becomes the responsibility of the school operating within district policies." (p.12)

The Industrial Education Guide noted that the Technology course did not necessarily have to be new and that successful Industrial Science courses could continue under the new designation, "Technology". This was in keeping with the advice given by the Technical Advisors in a 1976 edition of ie :

> If your popular Industrial Power program continues, call it Technology 11. If your exceptional Industrial Science 12 program continues, call it Technology 12. [emphasis added]
> (ie, 1976, n.d.,n.p.)

Among the greatest impediments to the success of Industrial Science 12 was the confused, often contradictory, conception of what the course was meant to be. As the deliberations of the Course Development Committee show, some of the developers openly viewed the course as science for the lower-achieving student who typically was found in the Industrial Programme. The emphasis on the "practical" and "concrete" was not viewed as simply an alternate mode of instruction, but as a necessary means of instructing the semi-literate, poorly motivated Industrial Programme students. Yet

others who worked on the Course Development Committee did not share this viewpoint. Instead, they conceived Industrial Science 12 as a more rigorous applied science course, perhaps a precursor to engineering studies, the practical nature of which would differ from academic courses in kind, but not degree.

This ambiguity was never resolved by the Course Development Committee. While committee minutes noted areas of "much discussion", committee members recalled two almost opposing camps separated by an unbridgable gulf. If one "camp" can be said to have prevailed, the teachers of Industrial Science 12 would have said that it was those who did not understand the academic limitations of the typical industrial education student. The nature of the lab activities and the reading level of the text were seen as inappropriate for an Industrial Education course.

The ambiguous aims of the Course Development Committee and the Department followed Industrial Science 12 into the schools. One of the recurring questions of the shop teachers in their surveys and meetings was that of understanding the goals and objectives of the course. The school, and society in general, expected industrial education to maintain its traditional role of imparting vocational and semi-vocational training to its typical clientele. How was

this to be reconciled with the apparently ambiguous objectives of the new course? Those who were responsible for implementing the course continually called for more direction as to how Industrial Science 12 fit into the overall goals of the Industrial Programme.

The haste in which the course was written exacerbated the equivocal nature of Industrial Science 12. Amid the wholesale changes to the industrial education courses, and the entire high school programme, little time could be spared for the one course. The rush to implement the new Industrial Programme, and thereby to receive the federal funding, was predominant. This is ironic in that the existence of Industrial Science 12 pushed the Industrial Programme to the magic 50 % level required to comply with TVTA guidelines. A teacher at that time remembered this push for implementation :

> They knew it had to be implemented because of the federal funds....In fact, one of the Department of Education people finally told them [BCSTA] at one time - when industrial education teachers were trying to delay the implementation and saying they needed more time to develop this - he said, " Well, take out your timetable and your <u>tides</u> table, and you could look up on September 2 what time the tide is coming in, and I'm going to tell you that the tide is coming in on September 2 and the course is going to go !"
> (Regan Interview, July 13, 1984)

The students of Industrial Science 12 did not respond positively to the course either. Their expectation for industrial education courses revolved around "making" things, working in the shop, and did not include laboratory work in science. Science was one of the things they assumed they had left behind in the academic programme. Almost all teachers interviewed expressed the opinion that students did not enjoy the course. The Industrial Science 12 teachers who had developed effective, activity-oriented courses over a number of years encouraged student interest, but these were the exception. In most schools, students viewed the course much as their instructors did, as simply an adjunct to the Industrial Programme.

An additional factor in students' unfavorable perception of the course was its nonacceptance as a science credit by post-secondary institutions. Not even the provincial Institute of Technology or the vocational institutes, which were responsible for most of the technical and vocational training in British Columbia, recognized completion of Industrial Science 12 as an acceptable science credit. Lacking even this incentive, student motivation dissipated.

The dearth of resource material for teachers with little background in the subject, which the BCSTA

tried to alleviate, was an important aspect of the course's failure. When the Department of Education did try to provide summer inservice sessions after the difficulties with the course became apparent, little interest was shown by the industrial education teachers, perhaps because of their reaction to the course noted previously.

There was also confusion as to responsibility within the Department of Education for support for teachers experiencing difficulty with Industrial Science 12. The two Technical Advisors had been Inspectors of Technical Classes whose role was just that - inspection. The position of Coordinator of Industrial Education had been established to act as liaison among the various levels of government for the TVTA funding and not curriculum. The Director of Vocational Curriculum worked mainly with the Department of Labour on apprenticeship programmes. Presented with the new course, teachers had few avenues through which to seek guidance. By the time the Department began to view Industrial Science 12 as a priority area, in 1970/71, its history over the previous four years had already determined its fate.

Other problems also mitigated against the successful implementation of Industrial Science 12. The shortage, or in some schools the complete lack, of

equipment for an applied science course was often noted by teachers. This shortage was despite the availability of federal funds under Program One of the TVTA, which the existence of Industrial Science 12 had made possible. The disbursement of the funds was the responsibility of the local school districts. The provision of facilities and equipment for this novel and enigmatic course often was subjugated to the more traditional and understandable requirements of the vocational-type courses.

The interdisciplinary nature of Industrial Science 12 as both a "science" and an "industrial education" course was also responsible for the perceived confusion with respect to the course. The Department of Education initially categorized Industrial Science 12 as both science and industrial education. The developers and Department officials extolled the virtues of science and industrial education teachers team-teaching the course, yet this occurrence was remarkably rare. Despite the merits of such a proposal, the ambiguous designation did not recognize many of the realities of secondary school departmental organization. The upshot was that neither the science nor industrial education departments felt a responsibility for the course. By 1967, the categorization of Industrial Science 12 as a

science course had been quietly dropped by the Department and it was listed solely as an industrial education course.

Industrial education teachers interviewed held curiously conflicting attitudes to the absence of science teachers instructing the course. Many spoke disparagingly of science teachers' unwillingness to teach any but the brightest students and their lack of understanding of industrial education. (11) Others spoke somewhat enviously of the ability level of students with whom science teachers worked. There was a definite opinion that science teachers disdained teaching the slower students and usually were excused from the task.

On the other hand, industrial education teachers expressed suspicion as to whether the "too theoretical" science teachers could properly teach such a course without destroying its special nature. One industrial education teacher commented :

> People don't change very much in a short period of time and those who had been teaching science for years, they went ahead with what they knew. It's almost impossible for them to have any depth of insight into what shops do. They just don't understand.
> (Seal Interview, July 23, 1984)

Another observed:

> I don't think it <u>has</u> to be taught by a shop teacher, but it would be best taught by a shop teacher. A lot of the science teachers have

> never worked - I mean other than teaching - and they were successful through school. They take five years of university and they're right back in school again. And they really don't have any practical application for the stuff they teach.
> (Wrinch Interview, July 12, 1984)

A certain pride was evident in industrial education teachers' felt ability to instruct students whom other teachers found difficult, and to keep the course practical and, hence, worthwhile. On the whole, industrial education teachers felt that Industrial Science 12 students were better served within the industrial education department.

Nevertheless, the desire to keep Industrial Science 12 within the industrial education department did not often translate into individual teachers' desiring to teach the course. Many teachers noted the "foisting" of the course on to the junior teachers' assignments - "the fellow who could least handle it". It was not a popular course among industrial education teachers:

> It was considered a dog of a course so it was given to the junior guy as much as possible in a lot of cases, and so it kept changing from teacher to teacher to teacher.
> (Wrinch Interview, July 12, 1984)

At the time, most industrial education teachers were tradesmen who had undertaken an "accelerated" programme to qualify as teachers. Their programme

would concentrate on courses in pedagogy and technical areas. Many, not having studied science themselves since high school, did not feel confident in instructing a science course. As tradesmen, they preferred to teach their own specialty area or a related area which they had studied during teacher training. Indeed, the structure of the industrial programme and school departments was based on this specialization.

> That was the problem. You see, most of us would take a double I.E. major - when I went through it was always Wood and Metal, and you got minimal electronics and a little bit of drafting. And so when you were appointed to the high school you had a Woodwork load, let's say, and if there wasn't quite enough and they needed some Industrial Science, they'd say, "Hey, Smith, you're teaching Industrial Science next year." Well, Smith wasn't prepared for it. (Wrinch Interview, July 12, 1984) (12)

Industrial Science 12 was never one's main area of responsibility - that would be one of the trade areas - and consequently received less attention by the teacher. In an effort to share the perceived burden, the course was often assigned to different teachers each year. While superficially a desirable practice, this resulted in a lack of continuity and resource development for the course. Each year, a teacher would have to begin anew.

The teachers' reaction to Industrial Science 12 ultimately sealed its fate. While much effort was

expended on the course by the BCSTA and, later, the Department of Education, much of it was "after the fact"; the dissatisfaction with the course had already been established. Lacking the wherewithal to provide the course as written by the Course Development Committee, and given the weak channels of communication to provide improvement, teachers' interest and belief in the course atrophied. Industrial Science 12, despite the hope that it would become an integral part of the Vocational Programme, became merely an imposed, isolated adjunct - the "orphan of the curriclum".

1. The January 1966 BCSTA Newsletter had posed the question of whether teachers wanted a workshop in Industrial Science 12 because "[i]ndustrial education teachers may find themselves teaching the course next fall...."

2. As well as "standard" science lab equipment, this would include such items as material and hardness testers.

3. The 1966/67 AR later stated that "[a] series of workshop were held...to prepare [teachers] to better handle the new material in Industrial Science [and other courses]" (p. F87), however, no mention of, in information concerning, these workshops has been unearthed. The BCSTA Archives, which are very complete in terms of meeting minutes and newsletter, contain nothing concerning Summer 1967 workshops other than the cancelled Kelowna sessions. It may be that the statement in the AR was a result of confusion on the part of two different authors of two different sections of the report.

4. Perhaps the tone of the year's work was indicated by a motion which was presented to a meeting of the Industrial Education Sub-Association of the Greater Victoria Teachers' Association in October. It was moved, rather ambiguously, that :

> our organization support Industrial Science for four (4) years on a trial basis [emphasis in original] before we decide to disband the course.
> (BCSTA, Minutes, Oct. 3, 1967)

Ross Regan, who attended this meeting, recalled that the intent of the motion was to support the course for a period of time, and not to assume the course's ultimate demise.

5. The cover of the February Newsletter, which Mr.Regan remembered drawing, showed a hand holding a "HELP" sign reaching up through ocean waves, with life preservers labelled "Industrial Science Materials", among others, being tossed to the unfortunate person.

6. Following this meeting, on February 26, 1968, the BCSTA Secretary wrote to the President of the British Columbia Science Teachers' Association requesting an opinion conerning the Olivo & Wayne text, Fundamentals of Applied Physics, and soliciting other suggestions. The selection of Olivo & Wayne was announced in the

Department's Curriculum Circular 25-3-68 (i.e., of March 3, 1968).

Most teachers felt that this text was inappropriate for their students both in content and reading level. One teacher described it as "first year university reading". The Coordinator of Industrial Education remembered it as a "difficult" text "and for a compulsory course, that is dynamite". The Industrial Education Textbook Selection Committee of the BCSTA, formed in 1965 to work in conjunction with the Department in choosing texts, established the selection of a new text for Industrial Science 12 as its top priority at an April, 1968 meeting, one month after the adoption of Fundamentals of Applied Physics.

7. The Advisors had formerly been called Inspectors of Industrial Classes.

8. This questionnaire, dated February 9 1968 investigated general facilities such as floor area, storage area, gas and water provision, et cetera. It also queried teachers concerning the specialized equipment required for Industrial Science, such as the heat-treating furnace, Rockwell hardness tester, moisture meter, optical comparator, et cetera.

9. There was no indication in the minutes as to how this could be accomplished. The status of Industrial Science 12 as a required course in both the Construction and Mechanics specialties had not been changed by the Department. However, during interviews with teachers of Industrial Science 12, it became clear that many schools offered alternate courses in a number of subject areas (math, plastics, additional woodworking, aeronautics, et cetera), yet reported these as Industrial Science 12 marks for the provincial "dogwood".

10. Although a copy of the survey instrument itself exists, no record has been found of the survey results. Mr. Rozell Smith, who developed the instrument, recalled in an interview the generally unfavourable tone of responses but no longer had the compilation.

11. An indication of this was given at the 1962 Annual General Meeting of the Science PSA, when the following motion was carried :

> ...that the incoming BC Science TA Executive be instructed to contact the Industrial Arts PSA

[sic] with a view to discussing the possibility of a greater liaison between science teachers and I.A. teachers. In this connection it would be fruitful to consider how the objectives of I.A. could be attained through the making of apparatus for science.
(BC Science Teachers' Assoc., Minutes, Apr. 25, 1962)

12. In 1967, a course titled "Materials and Technology" was added to the teacher training programme in response to the creation of Industrial Science 12.

Chapter 7

Conclusion

That a specific curriculum or course should arise as a result of societal pressures is not a unique situation. Although we may often think in terms of entire programs, individual courses and their revisions - in fields such as computer studies, values education, sex education, physics, et cetera- can often be seen as having had their genesis outside the immediate educational milieu. In the case of Industrial Science 12, the reorganization of the secondary school programme and the industrial programme within it are complicating factors in viewing it as an isolated course. Yet, in many ways, Industrial Science 12 was a keystone course of the industrial programme and its relatively unique and original conception makes consideration of it, as a distinct entity which resulted from societal pressures, worthwhile.

While no course can be considered totally in isolation from its particular programme and the overall educational offerings, there appears to be compelling evidence that Industrial Science 12 can be seen as a very specific response to a number of thorny

educational issues. As such, it is justifiable to discuss this specific course as a calculated answer to societal concerns being expressed at that time. On the drawing board, such a manifold solution as Industrial Science 12 must have seemed a godsend to those charged with responding to the myriad public and financial educational concerns of this period.

Industrial Science 12 can be considered a keystone course for a number of reasons. Its existence brought the various programmes of study within the Senior Vocational Programme up to the "50 %" time requirement for the TVTA Act Programme One (High School) funding. This was a crucial consideration for the reorganization of the Vocational Programme but, of course, this time requirement could have been met in any number of alternative ways. The appeal of Industrial Science as a concept lay in its hoped-for ability to address other perceived problem areas at the same time. The apparent perceptual confusion of the public with respect to scientific/technical education on the one hand, and vocational education on the other, would be tidily dealt with. Thus, the course could be pointed to as a curriculum response to both economic and geopolitical necessities. As a "vocational" course, it would be well-received by those groups which traditionally supported vocational-

education (very often, both business and labour). As a more academically-respectable variant of traditional industrial courses - perhaps a portent of future directions - Industrial Science 12 would also have been more acceptable to opponents of vocational education. The course also addressed the vexing question of "general" science, at least for vocational programme students. As such, it was a response to one of the major concerns raised by the Chant Commission, to which the Department of Education had to repond.

If the existence of Industrial Science 12 was to neatly serve a variety of functions, this might have served as a strong hint that the development of the course would be fraught with difficulties. The minutes of the Course Development Committee meetings and the recollections of members bear this out. The pressures for the course's completion were so strong, however, that adequate deliberation could not be given in the development of the curriculum. As a workable, usable curriculum - given the realities of school/department organization, teacher preparedness, student receptiveness, et cetera - Industrial Science 12 was seriously flawed.

The time constraints under which Industrial Science 12 was developed were strongly felt by all

involved. As a response to the Chant Commission, as a requisite for federal dollars, as a compulsory course for two-thirds of the Senior Vocational Programme introduced in 1965, Industrial Science 12 had to be in the schools by September, 1966.

Although the Department of Education had made at least a tentative attempt to provide some direction through the summer workshops of 1963 and 1964, once that material proved unusable it had to act quickly to meet its deadline. It had been hoped that the course would be ready for implementation with the entire Senior Vocational Programme in 1965. However, the Course Development Committee did not hold its first meeting until December, 1964; by then, the Department realized that the course could not be in the schools by September 1965.

Having reached this understanding with respect to its implementation date, the question arises why more time was not spent in deliberation of the course. Committee members interviewed for this study made constant reference to how busy they and the Chairman were at this time. With the entire senior secondary programme being rewritten, the Department of Education was extremely preoccupied. Meredith attended the first two committee meetings, but then passed responsibility to a seconded consultant. Prof. Cannon had other

curriculum development duties for the Science offerings. For industrial education specialists, the introduction of an entire Senior Vocational Programme complicated the scrutinizing of this one, rather unusual, course. With the Department's announced anticipation of the course's completion by the Spring of 1965 - although implementation was to be delayed until September 1966 - committee members apparently saw no option but to produce a curriculum.

The haste with which Industrial Science 12 was written mitigated against a clear understanding of the various ambiguities inherent in such a novel curriculum endeavour. The differing expectations and interpretations held by the course development team were necessarily put on hold because of the overriding concern to produce <u>something</u>. (1) Although the prescribed deadline of Spring, 1965, was realized by the Industrial Science Course Development Committee, its members do not remember the experience as a positive one, nor were they pleased with the resulting course. Of the five non-Department committee members, one had died and one could not be located when the present research was undertaken; the remaining three all expressed dissatisfaction with the completed Industrial Science curriculum. Mr. Seal described the course as being:

> hastily assembled out of ancient textbooks by people who were really short of time.

Mr. Winteringham stated :

> Let's face it - the course obviously wasn't made properly.... We didn't do the proper job.

Mr. Kirchner commented that he thought:

> it was really quite a gamble to implement this type of program and a lot was assumed by members of the committee.
>
> I would have to say there was not, even at the completion of this, high expectations of its success.

The crucial, if difficult to define, issue faced by the development committee was the degree to which Industrial Science 12 would be "theoretical" or "practical". Concommitant to this debate was the anticipated ability level of industrial education students. As detailed in Chapter 4, the committee was roughly split on this issue, with one group pushing for a more rigorous, academically-demanding approach and the other group stressing that such a conception could not succeed with industrial education students.

Interestingly, this split did not evolve along subject-specialty lines of committee members. It was not a case of science teachers demanding academic rigour and industrial education teachers resisting; at least one of the science teachers thought that the curriculum overestimated the abilities of the intended

students, and one of the industrial education specialists thought the committee was attempting to keep the curriculum at far too simple a level. The committee attempted, but failed, to reach a consensus on this issue. This philosophical disagreement was not a result of miscommunication or misunderstanding; it was open and acknowledged by members, but the obligation to produce a curriculum was overriding. The resulting course was viewed as an unsatisfactory compromise which, as the interview excerpts above indicate, pleased neither group.

Teachers of Industrial Science 12 did not view it as a compromise, however; they almost universally saw it as being overly "academic" and "theoretical". The Course Development Committee, with their assumptions about team-teaching and "good shop and good science", underestimated the difficulties of integrating two previously discrete subject areas in a school. Despite the optimistic words by the committee on this issue, a tacit understanding that this was to be an industrial education course taught by industrial education teachers seems to have coloured much of their deliberations : for instance, in the rather patronizing suggestion in the curriculum guide that the Science Department Head, the Principal, or "some other educational authority" could assist

with evaluating the lab book. (2) Notwithstanding this tacit premise, the Course Development Committee failed to appreciate the impediments to such a course and failed to provide the detail and direction needed by those who were to teach Industrial Science 12.

The introduction of Industrial Science 12 represented a huge leap of faith that teachers would make the course work. As the implementation studies of the last decade have made clear, the greater the desired change, the greater is the need for a sound implementation program. When Industrial Science 12 was introduced, this was not the truism it is today; the July 1966 workshop was the Department of Education's lone attempt to provide pre-implementation information. The unpreparedness of industrial education teachers and their unfamiliarity with such a programme were obvious from the outset. The BCSTA and, a few years later, the Department of Education attempted to compensate for this, but the aid was late in coming and a negative perspective on the course had by then been established.

Perhaps more important than mere unfamiliarity with this type of course was a lack of belief in, or sense of "ownership" of, Industrial Science, which would have worked to overcome the other hindrances. Although many industrial education teachers professed

support for the concept underpinning Industrial Science, the strength of their conviction is open to question. Prior to its introduction in the schools, or to their actually teaching the course, the idea of an industrial science course for industrial programme students was strongly supported by industrial education teachers. As one teacher put it:

> I don't think there was anyone who didn't think there was a real need for it and that the course was good. What always worried them was that they would have to teach it (Laughs). (Wrinch Interview, July 12, 1984)

Ultimately, the professed support for Industrial Science 12 was not strong enough to withstand the various classroom exigencies or to supersede what Sarason termed the "existing regularities". As discussed in Chapter 6, the shortage of both material and curriculum resources, the denial of post-secondary credit, the expectations of students, the traditional understanding of vocational programmes, all acted against the success of Industrial Science.

To a large extent, the noble attempt to integrate two subject areas may have been responsible for this result. Neither of the two subject groups carried a strong sense of responsibility for Industrial Science as it was being implemented. The Department of Education's rapid de-listing of the course as Science

left it by default an obligation of the Industrial Educaiton department. Whether by design or not, the Science department had unburdened itself of the problem of teaching "general" science to students in the Senior Vocational Programme. In those schools which came to offer alternate courses - under the name of Industrial Science 12 for the provincial "dogwood" - the ironic result was that Senior Vocational Students studied no science at all during their programme.

This study of Industrial Science 12 provided some support for Goodson's three hypotheses, discussed in Chapter 2, although important differences were noted. Goodson's second hypothesis- that subject groups "tend to move from promoting the pedagogic and utilitarian tradition toward the academic" - was partially, or temporarily, borne out by the example of Industrial Science. The development of an internal, applied science course for industrial students (as opposed to a general, "watered-down" science, or no science at all) must be seen in this light. And, as noted, teachers professed agreement with concept.

The "shifting amalgamations of sub-groups and traditions" were visible in the debates concerning the

course and the permutations it might follow. Goodson hypothesized that the boundaries and priorities would be determined by the relative influence of the sub-groups within that subject field. If we choose to consider Science as that subject field, it is clear that those who supported an industrial science course as an appropriate one for the field, and who felt it should be accorded some priority, did not achieve their end; Industrial Science 12 became unmistakably an industrial education course. If instead we consider Industrial Education as the subject field, the identification of two sub-groups - those who supported the course and those who did not - becomes possible.

Department and school board officials, faculty at the teacher-training unit, a select few teachers with strong science backgrounds and, initially, the BCSTA, were advocates of Industrial Science 12. Many of these advocates were in positions of influence within the industrial education field, and the conception of what could be considred an industrial education course was suitably altered to allow for Industrial Science. If a sub-group is to be identified as opposing this conception, it would be comprised almost solely of the shop teachers. As discussed above, this may have been based more on practical difficulties rather than

philosophical ones. The shortage of teachers among the strong advocates of Industrial Science 12 effectively scuttled its actual incorporation into the field of industrial education, despite the apparent success of its proponents. Ultimately, it is the teachers who have the greatest influence in determining the priorities of a subject and among industrial education teachers there was remarkable unanimity. Once Industrial Science 12 was settled within the Industrial Education department of a school, there was little internal debate concerning the course, and few "shifting amalgamations". Thus, the conceptual change which allowed Industrial Science to be considered an industrial education course was tentative and temporary.

It is interesting to view Industrial Science 12 in the light of Goodson's hypothesis which states that "much curriculum debate can be interpreted in terms of conflict between subjects over status, resources and territory" - subjects taught to the "most able" being the highest in status and consequently benefiting most in terms of resources and territory.

There is little doubt that high status would not accrue to science specialists teaching a specifically industrial course. As a course within the Senior Vocational Programme, it was understood that the "most

able" students in the school would not be taking the course. Consequently, little conflict was evidenced between Science and Industrial Education specialists over Industrial Science 12 as a subject area. It may well be that, with the understanding that Industrial Science 12 would be perceived as an industrial education course, the status aspirations of science teachers were better served by keeping the course at a relatively elementary level. Within a programme, such as the Senior Vocational, we may hypothesize that a "more academic" course would result in increased status for that specialty. Those in positions of influence within the subject community - such as Course Development Committee members - may well have felt this, as Goodson's hypothesis suggests. Given the small number of committee members, however, it is unreliable to ascribe motives to an entire subject specialty area based solely on the Course Development Committee's work. A more pertinent investigation might be made of the reactions of those who taught Industrial Science 12.

Those who taught the Industrial Science 12 were almost universally dissatisfied with the course. As noted earlier, few Science specialists taught the Industrial Science course; as a course within the Senior Vocational Programme, it was instantly

perceived as an industrial education course and was assigned to teachers on that basis. The promise of increased status was not sufficient to persuade industrial education teachers of the value of the course. Two possibilities can be suggested for this reaction : 1) the liklihood of one course increasing status was viewed as remote; or, 2) other considerations outweighed the desire for status.

Within the school, industrial education as a subject area enjoys very little status, yet in resource allocation of money and teacher deployment, it ranks near the top; this was true even prior to the advent of the TVTA. Industrial education, perhaps because of the special clientele and function it is seen to serve within the school, is not dependent on status - in Goodson's terms of instructing the most able students - for financial support. Therefore, the push for status which Goodson noted in his studies would not be necessary in the case of industrial education courses.

The lack of material resources for Industrial Science 12 in comparison with other industrial education courses, which many teachers mentioned, did reflect a lower status for the course but obviously not in Goodson's sense of being taught to less able students; the course was essentially compulsory for

those in the Senior Vocational Programme. If there was a group of students which could be considered more academically-able within the industrial stream, it would be those in the Electricity specialty who, as explained previously, were permitted to select Drafting 12 instead of Industrial Science 12. During interviews with industrial education teachers, this view of electricity students as the most able within the programme was repeated. Thus, even within the Industrial Education Department, no status according to Goodson's terms accrued to those teaching Industrial Science. Although Goodson's conception of status may have explanatory power when considering the entire range of programmes of a school, within a programme it appears to be lacking; many other factors impinge upon the attainment of status within a department.

The demise of Industrial Science 12, in retrospect, may be seen as inevitable. However laudable the educational concept of the course may have been, it was the more pragmatic concerns which initiated the course. Unfortunately, the same degree of pragmatism was not evident in the development and implementation of Industrial Science 12. It is tempting to suggest that the mere existence of the

course was to be sufficient and that its success, or lack thereof, in the schools was secondary. I believe this would be an exaggeration. There appeared to be a sincere belief in the value of Industrial Science on the part of those responsible for its creation and development; there was simply a lack of appreciation for the difficulties involved. It is to be hoped that future efforts in developing applied science courses will evidence a greater awareness of the curricular problems and a deeper committment to their resolution.

1. The wholesale verbatim borrowing from the Ontario curriculum guide, noted in Chapter 5, is a further indication of this concern.

2. The Department - despite initially categorizing the course as both Science and I.E. - seems to have shared this premise when directing Industrial Science 12 workshop information to "Industrial Programme teachers".

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