Consultation Report on the Draft Stage 6 Physics Syllabus

Evaluation team consisted of:

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Abstract

While many aspects of the Draft Syllabus in Stage 6 Physics were welcomed, the consultation process indicated difficulties in the draft syllabus which need to be adequately addressed if the final Syllabus is to be educationally and academically sound. Recommendations relating to these areas of identified difficulty are discussed in detail in the report but are stated below.

The Consultation Process

The draft syllabus was forwarded to schools and to other major stakeholders in science education during the week beginning Monday 15 March, 1999. Survey forms seeking detailed comment accompanied the draft syllabuses, with the deadline for their return to the Office of the Board of Studies being Friday 30 April, 1999. During the week of 19-23 April a series of meetings (5) and teleconferences (2) were held, through which input was gathered from teachers, with a range of teaching experience and from both Government and non-Government schools over a wide geographical (Focus Groups) and from other stakeholders in science education (Key Groups).

This report draws together the comments from all of these sources and makes recommendations in relation to the development of the final syllabus.

A recommendation has been made to revise the relevant aspects of the draft when:

- the majority of responses indicated support for a particular position. It is anticipated that those aspects of the draft syllabus will change.

A recommendation has been made to review the appropriate aspects of the draft when:

- feedback was relatively evenly divided as to whether a particular position should be adopted. It is anticipated that those aspects may not necessarily change.

Strengths of the Draft Syllabus

In general the various participants in the consultation process welcomed the production of new syllabuses in Stage 6 Science subjects and expressed support for the more contemporary approach to the writing of the Draft Syllabus in Physics, including the attempt to incorporate such a wide range of concepts from the field. The comment that the majority of the material included was “all good physics” was echoed by a number of participants, particularly in the Key Groups. While the contextual approach adopted in the draft was the subject of much comment, most participants recognised the value of the teaching of concepts within a contextual framework. As in any process of peer review however, the major thrust of the consultative input was in the form of criticism, although this was often constructive criticism, which should lead to substantial and beneficial review of the document.
**Major Issues For Consideration**

There were positive and negative responses to most questions. In Key and Focus Group meetings some questions were either not commented on at all by some groups or responses could not be construed as positive or negative, others questions elicited strongly positive or negative responses

**Stage 4 and 5 Outcomes**

The Key Groups unanimously agreed that the preliminary and HSC courses were built on the outcomes of the Stages 4 and 5 syllabus. One participant group (Association of Independent Schools, AIS) suggested that these outcomes provided a better underpinning of the HSC course than did the proposed Preliminary course outcomes and that this issue needed to be addressed.

**Indicative hours and course content**

The Key Groups unanimously agreed by all participants that there was far too much content (knowledge, understandings and skills) to be covered in the 120 indicative hours for each of the Preliminary and HSC courses. All groups further expressed their concern that the draft syllabus did not specify the necessary depth to which the material should be taught.

Attention was drawn by the Department of Education and Training (DET) representatives and by the Principals to the fact that the Stage 6 Science Symposium had strongly indicated that any new syllabus should teach “less science but teach it better”. The lack of specification of the depth of coverage of material and the immense scope of material included in the draft syllabus would not facilitate this recommendation from the Symposium.

Like the Key Groups, the Focus Groups unanimously agreed that there was far too much content for the 120 indicative teaching hours in both the Preliminary and HSC courses. All Focus Groups also indicated that the draft syllabus did not adequately specify the depth to which material should be covered. It was pointed out that the draft syllabus did not conform to the recommendation of the Stage 6 Science Symposium that “less science be taught better”.

Key points from the survey strongly reflected many of the concerns raised by both the Key and Focus Groups for Physics. In particular that the syllabuses contain too much content and that the expected depth of treatment of material is not well presented

**Issue for Consideration 1.**

*that the draft syllabus be revised throughout to clearly state the depth of coverage required*

*that the draft syllabus be revised throughout to reduce the content to a level which can be covered in the indicative teaching hours*

**Options**

All Key Groups indicated that options were appropriate. However, 4 groups were disappointed that the suggested content of the options was limited to a few dot points, making it impossible to assess adequately the scope or depth of the material to be included. Other issues addressed were:

- some of the suggested options did not lead on from core work in the HSC course
- a wider range of options was necessary to allow for differences in student interest, teacher experience and availability of resources in schools
- in view of the volume of material in the course, the inclusion of only one optional module rather than 2 would permit more time to be spent on the two core modules in the HSC course
- some of the material which will need to be removed from the core work to enable the course to be covered in the 240 indicative hours could be included in either existing or new options
All Focus Groups agreed that there was insufficient detail given in the proposed options for the questions regarding options to be properly answered, although they unanimously agreed that the inclusion of options was appropriate. One group suggested that content cut from the core could be included in new or expanded options and another indicated that one rather than two options would permit core content to be covered in more detail in the HSC course. Some additional optional areas were suggested:

- industrial applications of physics
- engineering applications of physics
- industrial and medical application of nuclear technology
- geophysics
- electrostatics

The survey returns indicated opinion to be that it is difficult to judge the scope and depth of the options for the HSC course, as too little detail is given in the draft syllabus and that further specification of the outcomes of the options is required.

**Issue for Consideration 2.**

*that the draft syllabus be revised to more specifically detail the scope and depth of the options*

*that the number and range of options for study in the draft syllabus be reviewed*

**Contexts and Conceptual Development**

While there was considerable support for the use of a contextual approach to teaching, most groups, including Tertiary Specialists, Tertiary Educators, NSW Science Teachers Association (STA), IEU and some members of the Principals Group, expressed the opinion that single contexts for each module were restrictive to teaching and learning, often resulting in fragmentation and lack of coherence in the conceptual development of material. Some members suggested that module material could be developed using a number of contexts in each, while others suggested that the contexts should not be made mandatory, but could be used or not used by teachers depending on their own interests/expertise and on the interests and experiences of their students. It was suggested by some members that the fixed contextual approach could disadvantage students from Non-English Speaking Backgrounds. One group also pointed out that certain contexts could become dated during the life of the syllabus.

Some specific problems or potential difficulties with certain contexts and/or their titles were raised including:

- possible safety issues with Housepower (students tampering with household electrical circuits) and The Driver’s World (students experimenting in their own driving)
- male gender bias in The Driver’s World
- the Driver’s World context - issue of the consideration of the feelings of students who have themselves or members of their family/friends been involved in traffic accidents
- over emphasis on space/astronomy in the Preliminary (The Cosmic Engine) and HSC (Space) courses, especially with a perceived lack of expertise in the physics of Astronomy by many teachers as this is not widely taught in undergraduate Physics courses
- inclusion of concepts of electricity into the Housepower module which do not really fit (eg. parallel circuits and Direct Current) - the context is too narrow for a full consideration of electricity
- inclusion of a number of other concepts which have been inappropriately fitted into contexts (eg. seismic waves in The World Communicates)
- titles of modules are very important to students possibly selecting the subject; for example childish titles for some contexts (eg The World Communicates compared to simply Communication) may dissuade students from taking the subject - pointed out by Final Year
Teaching Students)
• there are many better, and more appropriate separate contexts than the automobile to teach mechanics - the context is too narrow and the mechanics of vehicle motion is in fact much more complex than indicated in The Driver’s World module

The Focus Groups, were much more in favour of the use of the contextual nature of the modules than were the Key Groups, although one group found them restrictive and two preferred that teachers choose contexts to suit the knowledge and experience of their students or ones which better illustrated particular concepts. A number of specific points were raised in relation to the contexts themselves:
• some male gender bias throughout, especially The Driver’s World
• safety issues associated with Housepower
• contexts may date
• titles need to be better/more indicative of content than they are
• Housepower and The World Communicates should be reversed in order for better conceptual development (eg knowledge of electromagnetism required for The World Communicates before it has be introduced in Housepower)
• conceptually the material in the Cosmic Engine is too difficult for many students and not essential to understanding of Physics
• From Ideas to Implementation was seen not to follow on conceptually from other modules in either the Preliminary or HSC courses

Three of the Focus Groups also suggested that the material covered in the Preliminary course was mainly quantitative in nature, while that in the HSC course was mainly qualitative.

The survey returns indicated opinion to be that contexts are somewhat restrictive, especially in relation to the Preliminary modules, The Driver’s World and Cosmic Engine. Focus Groups were less concerned about the contextual basis of the draft syllabus than the Key Groups, but both considered the area quite closely.

**Issue for Consideration 3.**

that the use of single contextual settings for each module be reviewed in the light of input from the consultation process

**Skills**

All Key Groups expressed concern regarding the skills component of the draft syllabus. Several issues were addressed:
• there is not enough emphasis on skills
• there is too much emphasis on “research” and use of simulations rather than practical “hands-on” experiences, involving measurement
• the depth of coverage of material in the Students will learn to: sections of the draft syllabus is not specified and no indication is given of which/what depth of material is mandatory in these sections
• there is content material in the Students will learn: section which is not covered in the Students will learn about: sections
• concern was expressed by the BCC that students “will” learn may have legal ramifications

Concern was expressed by some focus groups regarding the skills (Students will learn to:) sections of the course. These included:
• too much emphasis on “research” and/or use of simulations rather than “hands-on” measurements
• not all skills are achievable by all students
• skills component of the course expected to be achieved by all students should be specified as mandatory

The survey returns indicated opinion to be that skills were not clearly mandated in the draft syllabus and that there were insufficient “hands-on” skills. Both of the Key and Focus Groups were in agreement with this proposition.

**Issue for Consideration 4.**

*that the Students will learn to: sections be revised to include more practical skills, and to indicate which skills are mandatory*

**Student Research Project**

Some members of all Key Groups agreed that the introduction of a Student Research Project (SRP) was good in principle but that there were an inordinate number of difficulties associated with its introduction, especially at the HSC level. All groups indicated that a SRP should only be introduced if these difficulties could be addressed in a satisfactory and equitable manner. Most groups were in favour of including the SRP in the Preliminary course but fewer suggested that it should be in the HSC course. Areas of difficulty with the inclusion of a SRP in the syllabus included:

• assessment - especially if it is included in the HSC course and in the external examination
• the need to produce large numbers of original topics for students to investigate and the almost inevitable scenario that these will be recycled from year to year, student to student, through the Internet etc
• equity issues relating to the differing resources available in schools/homes (eg. Internet access) and parent/family/friend expertise available to certain students (eg. academic parents/friends/family members)
• safety and liability issues (Occupational Health and Safety and Risk Assessment for each SRP)
• workload for students, especially those undertaking study in several subjects which have SRP (eg. other Science subjects) or equivalent (eg. Art, Drama, History and Design and Technology)
• teacher workload in the individual supervision of the SRPs, especially in large classes, and including the equity issues of certain students (eg. in small classes) being given more individual attention by teachers
• need for extensive inservicing of teachers on all aspects of delivery of SRP, including supervision and assessment

Two groups (STA and Principals) indicated that the SRP would probably be given little emphasis by schools/teachers if it was only included in the Preliminary course. Two groups (IEU and Principals) made the suggestion that SRPs could be externally marked, as is done in other subjects (eg. Design and Technology, Art).

Other individual suggestions were made on possible different configurations of the SRP within the syllabus including:

• incorporation of a smaller SRP into core module(s) or option(s)
• inclusion of some of the content material removed from the core into suggested SRP topics
• configuration of the HSC course to be 2 core modules, 1 option and 1 SRP

The Focus Groups were much more opposed to the inclusion of a Student Research Project in the HSC course (86% against) for many of the same reasons as were identified as difficulties by the Key Groups. These included:

• difficulties with assessment
• inequities arising from differential resource availability
• excessive student workload, especially for those doing more than one subject demanding a SRP or equivalent
• difficulties relating to “reuse” of projects from student to student, year to year, on the Internet etc
• insufficient time allocation
• problems with on-going topic choices
• lack of resources
• difficulties with assessment of joint projects between Science subjects
• teacher overload, especially in large classes

The survey returns indicated opinion to be that there is concern regarding a number of aspects of the proposed inclusion of a Student Research Project (SRP), including assessment, originality and authenticity of projects, as well as equity concerns in resource availability. These concerns were elaborated in more detail for physics by the Key and Focus Groups.

**Issue for Consideration 5.**

*that the inclusion of a Student Research Project be reviewed in the light of the input from the consultation process so that all of the concerns raised are adequately addressed in the final syllabus and that a Student Research Project not be included if this cannot be achieved by the content of the syllabus*

**Audience**

Most key groups indicated that the audience at which the draft syllabus was aimed seemed to be the “better” students, although they commented that it was difficult to decide in view of the fact that the depth of material was poorly outlined. Some participants thought that it could be taught to a range of students depending on the depth to which it was considered. The following other views were also expressed:

• the contextual approach could disadvantage the students who now did well in Physics
• the draft syllabus content, especially the contextual approach, could disadvantage students with English as a Second Language
• the draft syllabus may advantage girls and disadvantage boys
• the dumbing down or popularisation of the content material may attract students who would not normally be attracted to Physics

There was a wide range of views of members of the key groups on whether the draft syllabus would be likely to attract fewer, the same or less students than the current syllabus. The range included complete ambivalence to a definite belief in all three.

Four out of 7 Focus Groups saw the audience for the new Physics syllabus as “A or B” students and 2 other groups suggested that it was for the “elite”, although depending on the depth to which the material was taught it could be handled by weaker students, independent thinkers and lateral thinkers with less mathematics background. Four groups suggested that the new course would decrease the numbers of students taking the course, especially ones with poorer English literacy.

**Support Document**

As a result of the inclusion of considerable change in content and approach of the proposed syllabus, compared to the current 2 Unit Physics course, the meetings unanimously expressed the view that a carefully produced Support Document would need to be supplied to teachers. Suggestions on what must be included in this document included:

• lists of resources including software and websites
• suggested topics for student research projects
• detailed advice on assessment procedure
• Occupational Health and Safety and risk assessment procedures
• detailed bibliography related to each module
• glossary of terms
• teaching strategies within contextual areas
• sample examination questions and answers.

There was unanimous expression that the support document should be updated on at least a yearly basis to keep abreast of changes in the field.

All focus Groups indicated that a good Support Document was essential and that it should be in schools as soon as possible. There was an expression that the support document should be updated on at least a yearly basis to keep abreast of changes in the field.

Suggestion of what might be included in a support document included:
• lists of resources including software and websites
• detailed indication of depth to which material should be taught
• sample teaching programs for each module
• sample examination questions and answers
• specimen exam papers
• list of necessary formulae
• methods for verification of the originality/authenticity of student research projects
• suggested student research project topics

Several groups expressed concern regarding the time that it would take for authors/publishers to produce a textbook which students and teachers could use for the course. These groups indicated that this issue and the issues of inservice training and supply of resources need to be considered before the syllabus was implemented.

The survey returns indicated opinion to be that the provision of adequate support material will be essential and in reality it is difficult to assess the practicability of preparing and programming the material presented in the draft syllabus without having details of what support material will be available to teachers. Both the Key and Focus Groups stressed the requirements for a comprehensive and up-to-date Support Document

Issue for Consideration 6.

that the Support Document which will accompany the Stage 6 Physics Syllabus will include as many as possible of the items suggested by the Key Groups

that the Support Document will be updated during each year of the life of the syllabus

Assessment

Concern was expressed by the DET, BCC and the IEU that the “assessment tail should not wag the curriculum dog” and that the final examination should not be used to define the syllabus. This concern also related to the application of the bands of the Draft Performance Scale (Draft Syllabus document p. 103-104) which have been developed for Physics from the examination paper and student scripts from the 1997 HSC Examination. The DET indicated that there should be a strong statement in the syllabus about how these bands will be used by the Office of the Board of Studies and the BCC asked for clarification regarding the relationship of these bands to the syllabus outcomes. It was suggested that more detail needed to be given on the clarification of the future “refinement” (p. 103) of these bands in view of “further performance data and feedback from the consultation process” (p. 103)

Considerable concern was expressed regarding the possible inconsistencies and possible inequities
of the assessment of the SRP.

It was indicated that a specimen question on the SRP assessment in the HSC examination must be included in the syllabus Sample Assessment Items (p. 99-102).

The Principals group indicated that there needed to be clarification of the nature of examination questions in relation to contextual areas - would all examination questions be directly related back to the particular context in which the concept was taught?

Focus Groups also expressed concern that the syllabus outcomes should dictate the nature of the assessment and not vice versa. A number of other areas needing clarification with respect to assessment were indicated by some groups. These included:

- clarification of how the Performance Bands are to be “refined” (Draft Syllabus document p. 103) and applied
- general clarification of assessment procedures
- need for clarification of the nature of examination questions in relation to contextual areas.

**Issue for Consideration 7.**

that the draft syllabus be revised to clarify the area of assessment, especially in relation to the specific areas identified by the Key Groups and Focus Groups

**Other Issues**

A number of other important issues were addressed by one or more of the Key Groups and these are discussed below:

- The benchmark may be set too high in the Science Key Learning Area (KLA) compared to other KLAs. Concern was expressed by the BCC and IEU that this could reduce the opportunities for more students to participate in science education. The IEU indicated that there should be outcomes in the Physics course that all students could achieve and it was suggested in the discussion that this should be considered when more precise depth statements are added to the syllabus.

- Concern was expressed by the Principals, the Final Year Teaching Students and the STA that there was a problem in the development of concepts from the Stage 4-5 Science syllabus through the Preliminary work to the HSC. It was suggested that there was a shift from a theoretical consideration of concepts in years 7-10, though a more empirical approach in the Preliminary modules and back to a mainly theoretical consideration in the HSC course. These groups suggested that the conceptual progression should be spread more evenly so that empirical measurements and problems began to be confronted in the Preliminary modules and developed further in the HSC work in parallel with theoretical concepts.

- The reduction of the mathematical underpinning of physics was a concern to several groups and inconsistencies were pointed out where some important specific equations were given but not others. It was indicated that this needed to be addressed when the specifications of depth of coverage of material is considered.

- The Tertiary Specialist Key Group submitted details of incorrect physics included in the draft syllabus

- The major other issue addressed by the Focus Groups was the urgent need for the provision of inservice training and allocation of resources before the implementation of the final syllabus. Although these were seen as issues which needed to be addressed by the school
systems, the Focus Groups indicated that the Office of the Board of Studies be aware of these issues in the development and implementation processes for the Stage 6 syllabuses.

- The benchmark may be set too high in the Science Key Learning Area (KLA) compared to other KLAs and possibly set too high in Physics compared to other Science courses. Concern was expressed that this could reduce the opportunities for more students to participate in physics.

The survey returns indicated opinion to be that the mathematical basis of the course has been abandoned in favour of a quantitative approach. The Key and Focus Groups did not agree entirely with this proposition, but indicated that this area should be addressed during the revision process.

The survey returns indicated opinion to be that there was not sufficient attention given to the development of higher order outcomes, including problem solving. There was some agreement with this proposition by the Key Groups in particular.

**Issue for Consideration 8.**

that these issues be considered in reviewing the syllabus document

that the incorrect physics identified by the Tertiary Specialists be corrected in the syllabus revision

The survey indicated opinion to be that safety issues are inadequately addressed in the draft syllabus. Both Key and Focus groups raised this issue with respect to the SRP in particular, but it should be addressed in the syllabus as a whole.

**Issue for Consideration 9.**

that safety issues and risk assessment be more closely considered during the revision of the Students will learn to: parts of the syllabus

All Key Groups indicated that the time of 4 weeks allocated to the Revision of the draft syllabus following consultation (Draft Writing Brief document 5 January 1999 p. 1), would be inadequate to address the many difficulties identified by the consultation process. The majority of participants in the consultation process expressed grave concern that the proposed time-line for the development and implementation of the new syllabus, including the writing of the detailed content of HSC options and the preparation of a substantial Support Document was counter-productive to its ultimate educational success.

“[There was] some scepticism on how much change [resulting from the consultation process] will actually be made considering the course is to be implemented in less than 12 months” (Western Districts Teleconference) sums up a major concern by the Focus Groups. One group suggested an initial trialing of the syllabus to facilitate its better educational development.

The survey responses indicated opinion to be that the mistakes and poor grammar, phraseology and spelling indicate that the draft syllabuses have been prepared in haste.

**Issue for Consideration 10.**

that the time line of 4 weeks for revision of the draft syllabus be extended to enable the issues identified by the consultation process to be adequately addressed

Many participants, including members of the Systems, Tertiary Specialist, Board Consultative Committee (BCC), Independent Education Union (IEU) and Principals Key Groups and all Focus
Groups, pointed out that the first cohort of students entering Stage 6 in the year 2000 would be disadvantaged as they will not have completed the new Stage 4 and 5 Science course before embarking on the new Stage 6 course. As the Stage 6 course “draws upon and builds onto the knowledge and understanding, skills and values and attitudes in Stage 4-5 Science” (Draft Syllabus document p. 11), the majority of participants in the consultation process indicated that the implementation of the new syllabus should be delayed by at least one year.

The Focus Groups were unanimous in their concern that the first cohort of students into the Stage 6 course in the year 2000 would be disadvantaged by not having completed the Stage 4-5 Science Course, on which the outcomes of the Stage 6 Course are based. The groups asked for a delay in the implementation of the Stage 6 course until 2002.

The survey returns showed overwhelming opinion that the proposed implementation of the Stage 6 Syllabus in the year 2000 will disadvantage the first cohort of students who have not completed the Stage 4-5 Science Course.

The survey returns showed strong opinions that resourcing will represent an equity issue between schools. The Key and Focus Groups indicated that this was of particular concern with regard to equipment and expertise available for the supervision and execution of Student Research Projects (SRP) and the choice of Options available.

**Issue for Consideration 11.**

*that the time-line for the introduction of the new Stage 6 Science syllabuses into schools be extended by at least one year, but preferably until 2002*

**Summary**

**Issues for Consideration:**

1. that the draft syllabus be revised throughout to clearly state the depth of coverage required and that the draft syllabus be revised throughout to reduce the content to a level which can be covered in the indicative teaching hours
2. that the draft syllabus be revised to more specifically detail the scope and depth of the options and that the number and range of options for study in the draft syllabus be reviewed
3. that the use of single contextual settings for each module be reviewed in the light of input from the consultation process
4. that the Students will learn to: sections be revised to include more practical skills, and to indicate which skills are mandatory
5. that the inclusion of a Student Research Project be reviewed in the light of the input from the consultation process so that all of the concerns raised are adequately addressed in the final syllabus and that a Student Research Project not be included if this cannot be achieved by the content of the syllabus
6. that the Support Document which will accompany the Stage 6 Physics Syllabus will include as many as possible of the items suggested by the Key Groups and that the Support Document will be updated during each year of the life of the syllabus
7. that the draft syllabus be revised to clarify the area of assessment, especially in relation to the specific areas identified by the Key Groups and Focus Groups
8. that these issues be considered in reviewing the syllabus document and that the incorrect physics identified by the Tertiary Specialists be corrected in the syllabus revision
9. that safety issues and risk assessment be more closely considered during the revision of the Students will learn to: parts of the syllabus
10. that the time line of 4 weeks for revision of the draft syllabus be extended to enable the issues identified by the consultation process to be adequately addressed
11. that the time-line for the introduction of the new Stage 6 Science syllabuses into schools be extended by at least one year, but preferably until 2002