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Price, Glyn W.. 2019. “Advanced Supplementary Design and Technology Examinations in the UK: Criteria and Strategies for Curriculum Development”. figshare. https://hdl.handle.net/2134/1601.

Advanced Supplementary Design and Technology examinations in the UK: criteria and strategies for curriculum development

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Abstract

An Advanced Supplementary (AS) examination is deemed to be half of an Advanced level examination in the time required to teach the course, but of the same conceptual standard and rigour. This paper considers the conflicting demands of practical skills, knowledge content and design process in Advanced Design and Technology and presents alternative strategies for achieving the reduction of time for Advanced Supplementary. Coupled with the necessity to reduce teaching time is a new need for flexibility during the introduction of the UK National Curriculum in Technology which has knock-on consequences for the post-16 examination system. The changing demands of employment and higher education also apply constraints to the syllabus design. Some syllabus models are analysed and used to illustrate the strengths and weaknesses of various syllabus design decisions.

Introduction

The Advanced Supplementary Examination in the UK is intended to provide half an Advanced level examination (in content terms) without loss of the well-established standards associated with Advanced level. The fundamental principle is sound; two Advanced Supplementary examinations are to be equivalent to one Advanced examination, enabling students in sixth form and tertiary education some flexibility and opportunity of increased breadth of study without loss of quality. But the practice presents major problems. For a subject such as Pure Mathematics with Statistics, perhaps division into two equal components is not difficult, but for a subject such as Design and Technology, with its particular mix of process base, concept development, subject knowledge, social awareness and practical skills, the division is not so simple. To avoid misinterpretation in the following we shall omit the word "level" as applied to the full subject and half subject; by definition, the rigour and standard are to be the same for both Advanced and Advanced Supplementary examinations.

How is the Advanced course halved to give an Advanced Supplementary course? We need first to look at the content of the Advanced syllabuses. As a subject the ancestry of Design and Technology is mixed. There is a strong craft and design element in the syllabuses and in the teaching force prepared to deliver the content, including expertise in product design methods. There may also be some basis in art and design, business studies, science and/or mathematics, according to the syllabus under review. Does their inclusion need to be re-evaluated in the introduction of the Advanced Supplementary syllabuses?

The potential markets for Advanced and Advanced Supplementary examinations are quite different, and this difference will also influence the form of the syllabuses. The student committed to the Advanced course might see Design and Technology as a major component (normally one third) of his or her sixth form examined courses and may very likely have career interests which will make direct use of the knowledge and skills gained through that Advanced course. (A sample of sixth form Design and Technology students showed that, of those going into higher education, about half were aiming for engineering, about one third for design related courses such as architecture or graphic design, and one sixth towards other courses; Smithers and Robinson, 1992). The Advanced Supplementary student may wish to use a Design and Technology input primarily to complement or supplement other subjects. The different markets help us in developing the Advanced Supplementary syllabus.

To be effective Advanced or Advanced Supplementary Design and Technology might, for example, require inputs of...

(a) a conceptual framework of design theory, based on an understanding of the place of structured design methods and holistic approaches; this needs to be presented in such a manner that the student gains skills in optimising design methods and, with the student analysing his or her own thinking about the design in action, there enters an epistemological dimension to the subject (see also Denton, 1991; Oboho and Bolton, 1992).

(b) a knowledge base (of facts, terminology and methodology) providing a resource for design as a

starting point for further research by the student (Woodson, 1966); there is a danger of attempting to include an excessive knowledge base, yet to expect candidates to gain all knowledge and skills for the effective development of a project through direct reading and research is equally unreasonable; balance is essential. What are the key concepts here?

(c) time to permit the effective development of the practical skills of making; we are beginning to accumulate research evidence that even the basic psychomotor operations of directed construction require, for good quality of work, a high spatial ability and other cognitive inputs as well as the expected practical experience, muscular strength and dexterity (eg. Price and Reid, 1990); real curriculum objectives must include the psychomotor domain, but we must beware of equating this necessarily with the acquisition of traditional craft skills in wood, metal or plastics.

(d) awareness of the place of technology in society, its benefits and dangers, taught with factual balance and honest interpretation, as well as sensitivity to the personal views and interpretations of the students; this dimension will also include understanding of the world of business and industry and of the part to be played in that world by design activity and technological expertise.

(e) an understanding of the practical uses of information technology; whilst there are separate syllabuses to cover this subject area, it would be unrealistic to omit from any Design and Technology syllabus an understanding, at a practical level, of the power of modern techniques for handling data, text and graphical information. For example there is particular educational gain in the use of CAD/CAM (Owen and Heywood, 1990).

This list is not exhaustive. We could argue the place and desirability of many other features. It is suggested here, however, that the items listed above will be unacceptable to few professionals in this subject. We might also argue, for example, for a mathematical, scientific or aesthetic component to be present, but this might be more contentious. Though we might see a different model as being theoretically more desirable, there is a very real need to present a syllabus for which there is (or will be) a demand, both from the candidates and from those able to teach it.

The Content of Advanced Supplementary Syllabuses

When we come to halving an Advanced course we need sound criteria for cutting, and this includes not only criteria for elimination of material but, to account for the different prevailing markets, for inclusion in the Advanced Supplementary of material or methods not present in the Advanced. We need to clarify a few points...

(i) First, a core content for all syllabuses carrying the title Design and Technology is established by an inter-board working party. This core might comprise about 70% of an Advanced syllabus, so removal of that excess 20% of the Advanced syllabus plus material not in the core might provide an Advanced Supplementary syllabus of sorts, but this is a very unsatisfactory approach to meeting identified needs. We return to the need to state objectives, and to develop the syllabus from there.

(ii) Secondly, the conceptual framework of what constitutes design thinking is central to the scholarship of the subject. How much of the Advanced framework can be cut without the rule of maintaining an Advanced level of thinking being broken? (As the full experience of pupils doing National Curriculum Technology works its way through to the sixth forms a better starting point, or at least a common one, should emerge albeit that changes have continually to be made to update the National Curriculum in Technology.) It is difficult to see how the process base of Design and Technology can be substantially modified without reduction of the demands on the Advanced Supplementary candidate or else producing a syllabus which will not be seen by the centres as representing the Design and Technology subject title.

(iii) Third, the resource knowledge of Design and Technology does not have defined limits. Meeting need in the solving of design activity problems can draw on any relevant knowledge content. That the designer needs to have awareness of the wide range of knowledge resources available is clear. Equally, some readily available (at-the-finger-tips) knowledge will expedite good design. How much can be cut from the knowledge without reducing the demands of the subject? Again, the particular Advanced Supplementary market must influence this decision.

The Examinations

How have the examining boards coped with this dilemma? What criteria and methods have they used to produce an Advanced Supplementary

Design and Technology syllabus? We shall take as examples the work of four boards: Cambridge, Joint Matriculation Board (now Northern Examining and Assessment Board), London and Welsh.

Design process is examined in all as the major feature, through both course work and through written tests. The emphasis on course work is different in each:-

Each of these course work examinations requires detailed work of an appropriate Advanced standard. Each is examined within fairly tight constraints. The JMB project assessment scheme is particularly tightly structured. Given this inclusion of demanding course work how has the remainder of the syllabus been further cut to compensate? The Cambridge and London Boards use restricted topic areas as a means of limiting the time required to teach examinable content.

(a) Cambridge has a common core of basic design skills theory and of basic resources of materials, control, etc. together with option "modules" of electronics (instrumentation), computer aided engineering, materials processing, automation or structural mechanics. They emphasise that the project content is not restricted to the chosen

Table 1: AS Design and Technology Course Work Analysis.

Board	Course work	Format
Cambridge	50%	Project
JMB	60%	Project
London	70%	Year 1, two projects (20% + 20%) Year 2, one project (30%) based on chosen unit
Welsh	70%	Case study (20%) Major project (50%)

Table 2: AS Design and Technology Written Examinations Analysis.

Board	Written work	Format
Cambridge	50%	Design analysis and synthesis (20%) 2 1/2 hours Core and optional module (30%) 1 1/2 hours
JMB	40%	Revealed context (16%) General questions (12%) Comprehension and communication (12%) 3 hours.
London	30%	Design and Appraisal Compulsory short questions Two from four long questions 3 hours
Welsh	30%	Open book examination 3 hours

module only. The limitation of content is achieved by a very detailed specification of each module.

(b) London similarly has "units" from which the candidates select one. There is an option for centres to prepare their own units, given the usual adequate notice required by boards. There is an identity between Part C of the Advanced Supplementary paper and the corresponding units in the Advanced paper, thus achieving comparability of standard. The pre-specified units are (i) design and technology in society, (ii) materials, (iii) electronics and microelectronics, (iv) mechanisms and energy and (v) computer aided engineering.

The JMB and Welsh Boards use different strategies.

(c) The Joint Matriculation Board has sought to reduce constraints on subject matter, thus permitting centres to use the syllabus as a "framework" into which they can enter their own preferred emphasis of subject knowledge. It is not suggested that subject knowledge will be omitted. Some basic knowledge resource material is included but it is fairly limited and certainly not all that a candidate might reasonably require for study and course work. Content selection may be at the level of individual candidate or centre. This means that those candidates seeking to use the Advanced Supplementary syllabus in order to integrate their Design and Technology work with other Advanced subjects will have the flexibility to do so, not only through project work but also through theoretical studies, though it is not essential to the ideal of the subject that it is "parasitic" in this form. To overcome the problems of setting questions with relatively little common content the paper has the context (but not the questions) of Section A revealed on l December in the year preceding the examination. The candidates do specific research in preparation for this one hour design-based section. Section B has more general questions and some deliberate commonality of standard with part of the Advanced paper (and the same question setter). Section C is common with the JMB's other Advanced (Technology Systems) examination in the form of a design or technological comprehension and communication study.

(d) The Welsh Board tackles the problem by using a form of open book examination. The syllabus cautions its users regarding the problems associated with inadequate or excessive examination room resources. The content, like that of the JMB is not as detailed as that of the syllabuses restricting content, though the Welsh Board does give more detail of some traditional materials and processes requirements than does the JMB/NEAB.

The future through research

It is encouraging to see the existence of different approaches and that each one has flexibility regarding the type of candidate it can attract. Between them the syllabuses should begin to attract an increasing candidature. The Advanced Supplementary examination in Design and Technology is one area with substantial potential for growth, broadening the experience of many students.

This is all far too important in terms of its relationships with employment and higher education for ad hoc curriculum development and syllabus construction. There is great need to base the work on rigorous (and quantitative) research in the field of examination design so that the syllabuses tie in correctly with appropriate learning theory and career needs.

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