



Qualifications and
Curriculum Authority

Review of standards in A level computing and ICT: 1998–2004

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1. Introduction

The purpose of this study was to evaluate the demands of A level computing and ICT examinations for awarding bodies in England, Wales and Northern Ireland in 1998 and 2004. (Full details of the awarding bodies involved are outlined in Appendix A.) The nature of the materials reviewed provided an opportunity to consider the demands of the ICT and computing examinations at the same time.

Between them, the A level syllabuses included in this review attracted about 70 per cent of the nearly 24,000 candidates who took A level ICT or computing in 2004.

This enquiry provides details about standards in A level computing and ICT examinations across the awarding bodies AQA (Assessment and Qualifications Alliance), CCEA (Council for the Curriculum, Examinations and Assessment), Edexcel, OCR (Oxford, Cambridge and RSA Examinations) and WJEC (Welsh Joint Education Committee).

2. Examination demand in A level computing and ICT

The major issue that affected all A level examinations between 1998 and 2004 was the change in design of the A level qualification in line with the Curriculum 2000 reforms. This involved a move to unitised assessment based on a six-unit structure. The overall assessment of the A level qualification was split into the first half, Advanced Subsidiary (AS) and the second half, A2. The AS and A2 sections of the course were each assessed by three units, making six units for the A level overall. The level of demand of the AS qualification was reduced from the former Advanced Supplementary qualification, to allow a smoother transition for students moving from GCSE to A level and to allow the new AS to stand as a 'broadening' qualification in its own right. The main requirement of the changes was to carry forward the full A level standard.

The most significant changes for A level computing and ICT between 1998 and 2004 were:

- the change to a mandatory six-unit AS/A2 assessment structure, as described above
- a move to less demanding AS unit assessments and more demanding A2 units
- a requirement for synoptic assessment
- formalisation of the assessment of the quality of written communication
- changes to coursework.

A level computing syllabuses in 1998 were developed in the light of the A level computing subject core. Subject cores tended to deal with syllabus content but not structure. 2004 syllabuses in computing conformed to the Curriculum 2000 A level computing subject criteria. 2004 syllabuses in ICT were closely aligned with the Curriculum 2000 A level computing subject criteria.

Materials available

The reviewers considered the syllabus documents, examiners' reports and question papers with associated mark schemes from each of the awarding bodies in 1998 and 2004. The subjects reviewed are given in the table below. Awarding bodies were asked to provide materials for the syllabus with the highest candidate entry, in either ICT or computing. Details of the syllabuses included in the review are given in Appendix 1.

Year	Awarding body and syllabus				
	AQA	CCEA	Edexcel	OCR	WJEC
1998	Computing		Computing		Computing
2004	ICT	ICT	Computing	ICT	Computing

Assessment objectives

In 1998 there was considerable variation in the quantity and nature of assessment objectives stated within the syllabuses. However, although the objectives were presented quite differently, when considered in detail they were found to be broadly comparable. By 2004 all syllabuses used the concepts of AO1 (Knowledge and Understanding) and AO2 (Skills). Within these overall headings of AO1 and AO2, awarding bodies listed sub-sections that differed in number and style, but were comparable. In 2004 the awarding bodies clearly stated the proportions of AO1 and AO2 to be contained within AS and A level courses. At A level AQA and CCEA contained higher proportions of AO1 and lower proportions of AO2 than the other awarding bodies, but this was considered unlikely to lead to differences in demand.

There was much greater clarification of the assessment of the quality of written communication in 2004 than in 1998. However, in 2004 there was still variation among awarding bodies in the proportion of marks allocated to written communication overall, and also in the way in which question papers and mark schemes awarded such marks. The main difference was that some awarding bodies allocated marks to specific written questions, whereas others allocated them either to a whole paper section or to a whole paper.

Syllabus content

All awarding bodies stated comparable philosophies and aims in their syllabuses in both years. The 1998 computing syllabuses were generally concerned with the design and development process for computer applications, and with the technical aspects of computer operations. The general philosophies and aims were updated in 2004 to allow for developments – more material was introduced on the relationship between computers and society. These differences were to be expected, and did not lead to any variation in standards.

In 2004 there was an increase in the extent and range of support materials available. However, in terms of what was stated within the 2004 syllabuses, there was some variation across the different awarding bodies. The Edexcel and OCR syllabuses featured clear Tables of Contents and made explicit reference to the range of support materials and training available, while the WJEC syllabus did not make any such reference. The CCEA and AQA syllabuses did provide some information, but it was limited in its scope.

2004 syllabuses generally stated that no specific prior knowledge was required, other than national curriculum coverage. The AS section, therefore, introduced the fundamentals of the subject area, and the A2 section built on the topics introduced at AS level, increasing the range and depth of topics.

The content of AQA's 1998 computing and 2004 ICT syllabuses was comparable, although there were different numbers of sections and sub-topics. The schemes went into different topics – but in appropriate depth – and there was a good balance of coverage overall. AQA's syllabuses were somewhat less technical than others, although a great deal of depth on information management was apparent in 2004 unit 4, incorporating many demanding concepts. Some topics were common to both the 1998 computing and the 2004 ICT syllabuses, and these were covered in similar depth. The content demands of ICT and computing were different, but this was due to the distinct emphases of the two subjects. Both syllabuses covered systems architecture; legal, moral and social implications; applications; and structured analysis and design. The technical nature of the computing syllabus made it challenging in ways that ICT was not: computing included topics such as floating-point representation, principles of electronic communication and technical details relating to operating systems. The ICT syllabus demanded a wider degree of understanding from candidates, for example of the effect of ICT on society, individuals and organisations.

The reviewers judged that the 1998 Edexcel syllabus was more demanding than those of the other awarding bodies. This was because Edexcel required candidates to study a greater range of topics in significant depth. Several technical topics and theoretical concepts – for example software development and systems software with computer architecture – were dealt with in considerable detail, with candidates having to apply their knowledge to a wide range of contexts. However, the reviewers judged that there was a lack of comparability between topics; candidates' experience of the examination

could therefore depend on which optional questions they answered, as some were more demanding than others.

By 2004, requirements had been eased a little, and some topics had been removed, but the Edexcel syllabus was still slightly more demanding than those of the other awarding bodies. This was largely due to the fact that it included a wider range of topics, particularly at A2. The reviewers judged that the AS course for 2004 was of an appropriate standard.

Between 1998 and 2004 there was a slight reduction in the depth in which topics were covered in WJEC's computing syllabuses. However, this was balanced in 2004 by an increase in the range of topics covered – to include those usually found in ICT syllabuses. Naturally the AS content in 2004 was not covered in as much depth: for the operating systems topic candidates had to be able to describe their role, but they were not asked to go into the detailed technicalities of the functions they performed.

In 1998 both the AQA and the WJEC syllabuses set an AS level which was a subset of the full A level. The fact that the syllabuses made no assumptions about prior knowledge and understanding meant that the AS content provided an introduction to the subject, with the rest of the A level developing these topics and introducing others. The changes introduced by Curriculum 2000 were hence less dramatic in computing and ICT than they were in subjects which involved a clear progression route from GCSE. However, in 1998 AS did still contain some very demanding topics, which were subsequently moved to A2 units. In addition, the assessment of the AS in 1998 was at the full A level standard.

In 2004, OCR topics were up-to-date and wide-ranging; they included interactive television, networked audience participative broadcasting and health and safety issues. Helpfully for teachers and candidates, learning outcomes were clearly detailed in the syllabus. There were a reasonable number of theoretical concepts in the syllabus, mainly assessed through units 2512 and 2514. Structured practical tasks in unit 2513 required candidates to apply their skills, knowledge and understanding using application packages, while unit 2514 assessed these skills in the context of problems.

The 2004 CCEA syllabus provided a clear idea of the contents of each unit, and the depth of coverage generally seemed appropriate. Unit 1 was less demanding, consisting mostly of topics studied at GCSE. The language used to describe the topics and syllabus content was clear and no more technical than was necessary. The range

of topics appeared similar to most other syllabuses. There was a good balance between the technical aspects of hardware and software and the social implications of computer use. The number of topics covered at AS – 11 in total – was lower than for other awarding bodies. The A2 course consisted of a suitable number of topics. Overall, the reviewers judged the CCEA syllabus to be less demanding, due to the lighter content at AS.

The 1998 AQA and WJEC computing syllabuses were judged to have made comparable demands in terms of subject content. The Edexcel computing syllabus was thought to have been more demanding.

In 2004 the reviewers judged that three of the syllabuses (AQA ICT, OCR ICT and WJEC computing) were broadly in line in terms of subject content. Edexcel's computing syllabus was found to be slightly more demanding, due to the wider range of topics (particularly at A2). CCEA's ICT syllabus was judged to be the least demanding, due to lighter topic coverage at AS.

Scheme of assessment

There were significant changes in schemes of assessment between 1998 and 1994. These are presented in Table 1.

Table 1: Examination structures and timings in 1998 and 2004

Awarding body and subject	1998	2004 AS	2004 A2
AQA 1998 computing and 2004 ICT	Paper 1: 2 hrs 30 mins Paper 2: 2 hrs 30 mins (choice of three out of five questions in section B) Single coursework project (30 per cent) Total exam time: 5 hrs (70 per cent)	Unit 1: 1 hr 30 mins Unit 2: 1 hr 30 mins Unit 3: one piece of coursework (40 per cent) Total exam time: 3 hrs (60 per cent)	Unit 4: 2 hrs Unit 5: 2 hrs Unit 6: one piece of coursework (40 per cent) Total exam time: 4 hrs (60 per cent)

<p>CCEA</p> <p>2004 ICT</p>		<p>Module 1: 1 hr 30 mins</p> <p>Module 2: 1 hr 30 mins</p> <p>Module 3: one piece of coursework (40 per cent)</p> <p>Total exam time: 3 hrs (60 per cent)</p>	<p>Module 4: 1 hr 30 mins</p> <p>Module 5: 1 hr 30 mins</p> <p>Module 6: one piece of coursework (40 per cent)</p> <p>Total exam time: 3 hrs (60 per cent)</p>
<p>Edexcel</p> <p>1998 computing and 2004 computing</p>	<p>Paper 1: 3 hrs (choice of four questions out of six in section B)</p> <p>Paper 2: 3 hrs (choice of four questions out of six in section B)</p> <p>Single coursework project (33.3 per cent)</p> <p>Total exam time: 6 hrs (67.7 per cent)</p>	<p>Unit 1: 1 hr 30 mins</p> <p>Unit 2: 1 hr 30 mins</p> <p>Unit 3: one piece of coursework (33.3 per cent)</p> <p>Total exam time: 3 hrs (66.7 per cent)</p>	<p>Unit 4: 1 hr 30 mins</p> <p>Unit 5: 1 hr 30 mins</p> <p>Unit 6: one piece of coursework (33.3 per cent)</p> <p>Total exam time: 3 hrs (66.7 per cent)</p>
<p>OCR</p> <p>2004 ICT</p>		<p>Unit 2512: 1 hr 30 mins (30 per cent)</p> <p>Unit 2513: set coursework tasks (40 per cent)</p> <p>Unit 2514: 1 hr 30 mins (30 per cent)</p>	<p>Unit 2515: 1 hr 30 mins (30 per cent)</p> <p>Unit 2516: one piece of coursework (40 per cent)</p> <p>Unit 2517: 1 hr 30 mins (30 per cent)</p>

		Total exam time: 3 hrs	Total exam time: 3 hrs
WJEC	Paper C1: 2 hrs	CP1: 1 hr 30 mins	CP4: 2 hrs
1998 computing	Paper C2: 2 hrs	CP2: 1 hr 30 mins	CP5: 2 hrs.
2004 computing	Paper C3: 2 hrs	CP3: one piece of coursework (34 per cent)	CP6: one piece of coursework (34 per cent)
	Paper C4: 2 hrs		
	(All questions compulsory)	Total exam time: 3 hrs (66 per cent)	Total exam time: 4 hrs (66 per cent)
	Coursework (30 per cent) – either two Project P3s or Project P1 and Project P2		
	Total exam time: 8 hrs (70 per cent)		

The Curriculum 2000 changes introduced an explicit requirement for synoptic assessment, and in 2004 all syllabuses contained clear information about how it would be conducted. The CCEA syllabus stipulated a minimum of 15 per cent synoptic assessment, while the minimum for the other awarding bodies was 20 per cent. This indicated that CCEA's requirements were less demanding. With the exception of AQA, the syllabuses of all awarding bodies specified the units in which the assessment would take place.

In 1998 there was a lack of comparability across the schemes of assessment for the computing syllabuses. AQA and Edexcel had very similar schemes, with two written papers (totalling 5 and 6 hours respectively) and a single coursework project, which was worth about a third of the overall marks. WJEC had four written papers, leading to a much longer overall exam time of 8 hours. Furthermore, although coursework was again worth about a third in the WJEC syllabus, candidates had to undertake two projects instead of just one. These differences led to variation in demand across computing

syllabuses in 1998, with WJEC judged to be more demanding than the other awarding bodies.

There were minor differences in approach to question papers in 1998, with AQA using a combined question-and-answer booklet for Paper 1. (Candidates answered on a separate sheet for all other papers.) AQA and Edexcel allowed candidates some degree of choice when answering questions – they had a choice of 3 out of 5 questions or 4 out of 6 questions in section B on one or both papers. There was no choice in the WJEC question papers.

ICT syllabuses accorded a greater weighting to coursework than computing syllabuses did. The computing syllabuses for both 1998 and 2004 allocated about a third of the marks to coursework, while in ICT syllabuses from 2004 coursework was worth 40 per cent.

Schemes of assessment for ICT and computing at AS were very similar across the awarding bodies in 2004. But there were a few differences, which had minor implications for the comparability of demand across the awarding bodies. For example, there was some variation in the number of marks available in the written examinations – ranging from 120 marks for AQA and WJEC to 180 marks for OCR and CCEA. This was despite the fact that the assessment times were the same in all cases. OCR and CCEA used combined question-and-answer booklets, whereas the other awarding bodies did not. All awarding bodies stated clearly the number of marks allocated for the quality of written communication, and in AQA's case it was assessed in the coursework unit at AS.

At A2 in 2004, schemes of assessment were again broadly similar across the awarding bodies, with each body having two written papers and one coursework assignment. The variation in overall examining time was lower than in 1998 but differences remained in 2004. Examining times for AQA and WJEC were longer than those for the other awarding bodies, at four hours.

The total number of marks available on the written papers also varied – from 120 for Edexcel to 180 for AQA, OCR and CCEA. This caused very significant differences in the mark rates allocated by the awarding bodies, with OCR and CCEA having almost double WJEC's rate (1 mark per minute compared to 0.58). There did not seem to be a clear rationale for this, and the reviewers judged it as a source of variation in demand. All awarding bodies allocated marks for the quality of written communication within

written papers at A2, with Edexcel allocating the greatest proportion of marks to this area.

Options

None of the syllabuses in either year offered a choice of components in their schemes of assessment. In 1998 there was a degree of choice within written papers and, for WJEC, in coursework. AQA and Edexcel candidates had some degree of choice when answering questions: section B of AQA's Paper 2 only required candidates to answer three out of five questions, and both Edexcel papers offered candidates a choice of four questions out of six in section B. The reviewers judged the choices provided by AQA to be comparable with one another. But they considered that there was a lack of comparability between routes through the Edexcel examination, as some optional questions were more demanding than others. In 2004 all questions on written papers were compulsory, removing this source of variation in demand.

Question papers

The reviewers identified some variation between awarding bodies in the 1998 computing question papers.

AQA's 1998 question papers were well structured, and many questions were accessible to lower-attaining candidates. There was a lot of independence between parts of questions, so that failure in one part did not prevent access to another. There was also plenty of material to provide discrimination at the top end of the attainment range.

Edexcel's question papers in 1998 were rather uneven: there was some very challenging material in the section B parts of the papers, but the optional questions were not entirely comparable in terms of demand. This was reflected in the Chief Examiner's report, which stated that most candidates had avoided the essay question in Paper 2. Most questions, however, were considered to be at the correct level.

WJEC papers in 1998 contained a large number of short-answer, heavily-structured questions, which afforded candidates limited opportunities to demonstrate strategy and planning in their answers. Most papers were made up of question sub-components that required short answers and demanded fairly specific knowledge. Consequently, the reviewers judged that a weaker candidate might have had limited opportunity to achieve in some questions – they either knew the answers or they did not.

By 2004, question papers had generally improved. AQA question papers continued to be well-structured and accessible to lower-attaining candidates, while offering appropriate challenges to higher-attaining candidates. The reviewers noted that the main difference between AQA's papers in 1998 and 2004 was that the 1998 A level computing questions were a little more complex than the 2004 A2 ICT questions. This was thanks to the level of comprehension and technical detail required, together with the linguistic demands of the questions. Overall, however, the reviewers judged the demands of the 1998 AQA computing papers and the 2004 AQA ICT papers to be fairly similar.

By 2004, Edexcel's question papers were generally much more even in terms of demand, although the reviewers judged that the section B parts of the A2 papers were slightly over-demanding. All papers were thought to offer good accessibility for lower-attaining candidates, particularly in section A. However, there were considerably more marks available in section B. In addition, the reviewers found that some section B questions required candidates to assimilate a large volume of information in order to give their answers, placing unfair demands on them.

The reviewers also noted that the structure of the Edexcel papers led to over-representation of some syllabus topics at the expense of others. This was because section B comprised two compulsory questions, each worth 18/60 marks. For example question 7 on unit 1 was entirely concerned with the understanding of spreadsheet concepts, which was only a small syllabus sub-section.

By 2004, WJEC question papers had improved, with discriminating questions for higher-attaining candidates and better differentiation for weaker candidates. The 2004 papers contained a better range of question styles, giving all candidates the opportunity to show what they could do. The 2004 examiners' report suggested that weaker candidates scored quite well on the essay questions, where they could gain some marks. However, the review of candidates' work suggested that problems remained at grade E: the high proportion of short-answer questions on the AS papers requiring very specific knowledge made it difficult for candidates to demonstrate the full extent of their knowledge, understanding and skills.

The reviewers judged that the 2004 CCEA AS question papers were insufficiently demanding, as a result of the language employed and the small number of stimuli used. In addition papers were very structured, so that there were few instances in which candidates were required to devise a strategy to solve a problem. Furthermore, the level

of demand was uneven across the two units: unit 1 in particular was very straightforward, mainly featuring routine questions that required factual recall. There was little on this paper to differentiate between low- and high-attaining candidates. The unit 2 question paper was a little more demanding, but it would have been better if there had been more balance across the two papers, and also if both papers had been more demanding. This reinforced the effect of the CCEA AS syllabus content being less demanding than that of the other awarding bodies. Candidates were required to cover fewer topic areas and the topics for unit 1 were particularly undemanding, with little material extending beyond the key stage 4 programme of study.

The CCEA A2 question papers were judged to be of an appropriate level of demand. They contained more complex stimuli and fewer structured questions. There was an appropriate amount of material accessible for lower-attaining candidates, and both A2 papers contained some questions that enabled grade A candidates to be awarded marks appropriately. The reviewers judged that the undemanding nature of the AS in terms of content and question papers led to overly steep progression for candidates between AS and A2. Overall, CCEA question papers were judged to be less demanding than those of the other awarding bodies, due to insufficient demand at AS.

The reviewers judged that the 2004 OCR question papers were generally satisfactory. The AS papers lacked questions requiring the manipulation of data and the analysis of algorithms, but this was compensated by the pre-set tasks in coursework unit 2513. The A2 question papers required considerable knowledge, skills and understanding. The reviewers felt that these papers could have included a larger number of question parts aimed at lower-attaining candidates. The assessment grid showed that the appropriate allocation of marks had been awarded to grade E questions (47 per cent) at AS. Overall, the grade E allocation at A2 was 69 out of 180 (38 per cent), and it was not evenly split across the two units. This was certainly less generous than at AS, and the reviewers judged that a few more grade E marks on these papers would have been appropriate. All assessment grids showed a reasonable allocation of marks to question parts aimed at grade A candidates.

On the evidence presented, the quality of written communication was not assessed within OCR question papers in the required manner. The syllabus stated that question paper rubrics would inform candidates of which questions would carry marks for the quality of written communication. However, the rubrics stated only that the quality of written communication would be assessed within the question paper. In addition, the

mark scheme gave no indication of where or how the quality of written communication would be assessed.

Coursework

In 1998, coursework was of a similar nature and standard for both AQA and Edexcel: for both awarding bodies candidates completed a single project which required system analysis, design, implementation and testing. The WJEC syllabus required two pieces of coursework and also allowed for two optional routes. Candidates completed either Projects P1 and P2 or two P3 projects. Projects P1 and P2 involved problem analysis and design (P1) and problem implementation and testing (P2). The P3 projects involved the analysis, design, implementation and testing of two mini-projects. The reviewers judged the requirement for two pieces of coursework to be more demanding than the requirements of the other awarding bodies. In addition, they found a lack of comparability between the two optional routes, with the P3 option considered to be more demanding.

A key change to coursework requirements between 1998 and 2004 was that all candidates had to produce two pieces of coursework in 2004 – one at AS and one at A2. In ICT, coursework was weighted at 40 per cent, while in computing it carried about a third of the overall marks in both 1998 and 2004.

Across the ICT syllabuses in 2004, AQA and CCEA had quite similar requirements: a limited project requiring the use of generic software at AS, and a realistic problem for a real end-user at A2, with the expectation of advanced software functionality. OCR adopted a totally different approach at AS, using pre-released set tasks. But the reviewers judged that this was an interesting and valid method to use with students in their first year of the A level course. In particular, it enabled candidates to meet the requirements of the assessment objectives in ways that other approaches did not. The OCR A2 coursework requirements were the same as for AQA and CCEA.

The 2004 computing syllabuses had a different approach to coursework. WJEC's approach was considered particularly demanding at AS, as the focus was on a real end user: candidates were asked to produce a prototype, and this required the same knowledge and understanding as a full system would have. The reviewers felt that this was an especially demanding task – particularly given that coursework carried less weight in computing than it did in ICT. At A2, WJEC candidates were required to re-evaluate and extend their AS coursework – and the reviewers were concerned that this meant that candidates' performance at A2 could be unfairly affected by their

performance at AS. Candidates whose AS projects were either unsuccessful or especially good were likely to encounter difficulties with the A2 coursework, for which they were required to respond to feedback from a real end user.

Edexcel candidates, on the other hand, had the option of either re-evaluating and extending their AS material or producing a separate full system.

3. Summary of findings from review of syllabuses

- Although there were changes in the way assessment objectives were presented between 1998 and 2004, there were no significant differences in their content – either over time or between awarding bodies.
- In 2004 all awarding bodies (with the exception of AQA) allocated some marks to the assessment of written communication in written papers at AS. At A2 all awarding bodies did so, although this was not confirmed in the OCR mark scheme.
- The 2004 CCEA ICT syllabus had a minimum of 15 per cent synoptic assessment – which was less than the minimum of 20 per cent specified by the other awarding bodies.
- Overall, the reviewers judged that there was some variation in demand between the computing syllabuses in 1998. The WJEC scheme of assessment was more demanding in terms of the number and length of examinations, and in terms of its coursework requirements. WJEC question papers also offered limited opportunities for weaker candidates to demonstrate what they knew, understood and could do.
- The 1998 Edexcel syllabus featured a deeper and broader range of topics than the other awarding bodies. However, some topics were more demanding than others. In addition, question papers were uneven, with some particularly demanding optional questions.
- In 1998, coursework was of a similar nature and scope for both AQA and Edexcel – a single piece of work was required in both cases. WJEC coursework was more demanding – two pieces were required, and two optional routes were allowed, one of which was more demanding than the other.
- By 2004 all candidates had to complete two coursework units: one at AS and one at A2, with coursework carrying a slightly higher weighting in ICT than in computing.
- The reviewers judged the 2004 AS coursework requirements in computing to be more demanding than in ICT, particularly in WJEC's case. In ICT all coursework projects were discrete. In computing, A2 projects involved the re-evaluation of AS work, with WJEC candidates not having the option to start a new project at A2. Performance in coursework at A2 could therefore be dependent on performance in the AS coursework unit.
- The 2004 OCR ICT syllabus adopted a unique approach to coursework at AS, which gave candidates a wide understanding of a variety of software packages.
- Although there were some good question papers in 1998, the overall standard of question paper-setting had improved by 2004.

- By 2004, all choice had been removed from question papers. This change helped to make the demands of the awarding bodies more comparable, and to remove variation caused by differing demand across optional questions in Edexcel.
- In 2004 the Edexcel computing syllabus was judged to be more in line with the syllabuses of the other awarding bodies, although still a little more challenging – both in terms of content and in terms of some of the questions asked.
- In 2004 there were fewer topics at AS in the CCEA syllabus, and their question papers were less challenging overall.
- Despite some minor differences in content and in the nature of assessment between ICT and computing, the reviewers found that overall demand was broadly comparable across the two subjects at A level.

4. Standards of performance

Materials available

The reviewers considered candidates' work from all the awarding bodies in 2004, and from AQA, Edexcel and WJEC in 1998. There was no 2004 A2 grade A work from OCR, and no 2004 A2 grade E coursework for Edexcel candidates. Details of the materials used are provided in Appendix B.

A2 scripts for 2004 were compared with A level scripts from 1998. AS scripts from 2004 were compared across awarding bodies – but not with 1998 A level scripts, as the Advanced Subsidiary is a new qualification at a different standard.

The reviewers commented on the difficulty of comparing ICT and computing candidates, as the two subjects have different emphases.

Review of performance descriptions

The reviewers considered QCA's published AS and A2 performance descriptions for ICT and computing in the light of candidate work reviewed. Where the reviewers identified aspects of candidates' work that did not match the performance descriptions, these features are highlighted in bold and discussed in the comment that follows. On some occasions, candidates' work did not match the performance description because candidates failed to demonstrate a particular feature which was tested. On other occasions, performance did not match the description because the question papers did not require candidates to demonstrate a particular feature.

Performance descriptions for ICT contain statements relating to the quality of written communication, while descriptions for computing do not. Computing candidates generally demonstrated similar performance in this area.

Standards of performance at AS computing grade A

Table 2: AS computing grade A performance descriptions

Assessment Objective 1	Assessment Objective 2
Candidates characteristically:	Candidates characteristically:
a) demonstrate a good understanding of the main principles of solving problems using computers. They demonstrate a comprehensive understanding of a range of applications of computers and the effects of their use in a variety of contexts. Candidates show a good understanding of the organisation of computer systems and their component parts including software, data, hardware, communications and people;	a) acquire the skills to apply the knowledge and understanding of Assessment Objective 1 to developing computer-based solutions;
b) demonstrate knowledge and understanding of:	b) demonstrate the ability to:
i. hardware, communications and a range of software and user interfaces;	i. derive most of the user and information requirements of a system, considering the human aspects and physical environment;
ii. the characteristics of information and data types/structures;	ii. justify the need for and appropriateness of a computer-based solution to a problem;
iii. the methods of finding and using information to facilitate its effective use;	iii. specify and document methods of solution and data structures;
iv. the systems development life cycle and consequences of current uses of computing;	iv. select appropriate hardware and software and techniques for their use in solving a given problem;
v. the systematic approach to problem solving and software development;	v. document the selection of appropriate hardware and software, and the method of testing the solution;
vi. the characteristics of networks and importance of adopting standards.	vi. successfully implement the solution to a problem;
	vii. carry out and evaluate testing.

AS computing grade A

The reviewers judged that, in general, candidates demonstrated a comprehensive knowledge and understanding of the assessment objectives, and that candidate work displayed many of the characteristics stated in the performance descriptions. However,

there was little evidence of candidates being required to display knowledge and understanding of the methods of finding and using information to facilitate its effective use.

Standards of performance at AS ICT grade A

Table 3: AS ICT grade A performance descriptions

Assessment Objective 1 Candidates characteristically demonstrate:	Assessment Objective 2 Candidates characteristically demonstrate:
a) an appropriate understanding of the principles of information systems and associated basic theoretical concepts;	a) effective and appropriate use of a range of software;
b) a good understanding of the administration of ICT systems;	b) an ability to design and produce high-quality, efficient solutions to problems;
c) an appropriate and accurate use of technical language;	c) methodical, analytical and critical approaches to problem-solving;
d) a detailed knowledge of a range of applications packages;	d) the ability to design, operate and justify appropriate testing strategies;
e) a knowledge of the effects of ICT on society, individuals and organisations;	e) clear communication of design decisions and solutions to problems;
f) the application of knowledge and understanding to unfamiliar problems;	f) skills of evaluation;
g) a good understanding of data types, objects, relational databases and structures and how these are used;	g) an ability to design suitable user interfaces for a range of situations;
h) a good knowledge of common application generators;	h) appropriate communication skills;
i) a detailed knowledge of systems software;	i) the ability to select appropriate hardware and software for a particular situation.
j) a good understanding of human-computer interfaces;	
k) a thorough knowledge of the characteristics of a range of hardware.	
The candidate has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another smoothly and logically. Arguments will be consistently well structured. There will be few, if any, errors of grammar, punctuation and spelling.	

AS ICT grade A

The reviewers judged that, in general, candidates demonstrated a reasonable knowledge and understanding of the assessment objectives, and that candidate work displayed most of the characteristics stated in the performance descriptions. Candidates displayed both breadth and depth of knowledge and understanding – although only across a subset of the performance criteria. In practical work – where candidates are expected to demonstrate the effective and appropriate use of a range of pieces of software – it was common to see candidates only using a single piece of software, rather than a range (except for the use of a word-processor for the write-up). Few examination questions demanded software-specific answers, and this prevented candidates from displaying knowledge and understanding in this area. OCR candidates were the exception, as the structured tasks in their coursework unit required them to demonstrate the use of a range of pieces of software. Candidates were unable to display their knowledge of common application generators, as this was rarely tested. As question papers generally did not require a thorough knowledge of the characteristics of a range of pieces of hardware, performance in this area also tended to be limited.

Standards of performance across awarding bodies in computing and ICT at AS grade A

Standards of performance were comparable across awarding bodies at this grade boundary.

Standards of performance at AS computing grade E

Table 4: AS computing grade E performance descriptions

Assessment Objective 1	Assessment Objective 2
Candidates characteristically:	Candidates characteristically:
a) display a basic understanding of the main principles of solving problems using computers. They have some understanding of a given range of applications of computers and the effects of their use. Candidates demonstrate a basic understanding of the organisation of computer systems, recognising the part played by software, data, hardware, communications and people;	a) acquire the skills to apply the knowledge and understanding of Assessment Objective 1 to develop simple computer-based solutions to a given problem;
b) demonstrate awareness of:	b) demonstrate the ability to:
i. hardware, communications and a range of software and user interfaces;	i. derive some of the user and information requirements of a given problem;
ii. basic data types and the need to organise data for given purposes;	ii. select appropriate hardware and software and techniques for their use in solving a problem;
iii. the stages of systems development and problem-solving;	iii. carry out testing;
iv. the consequences of current uses of computing.	iv. produce documentation.

AS computing grade E

In the main, it was considered that candidates' work demonstrated a fair coverage of the relevant performance descriptions. However the coursework sampled contained only very simplistic documentation. The weakest candidates were able to devise quite good systems, but were not able to produce effective documentation for those systems. The reviewers noted that the performance descriptions and the assessment criteria for coursework did not give significant weight to implementation skills, whereas candidate work often demonstrated that skill more than any other.

Standards of performance at AS ICT grade E

Table 5: AS ICT grade E performance descriptions

Assessment Objective 1 Candidates characteristically demonstrate:	Assessment Objective 2 Candidates characteristically demonstrate:
a) a relevant knowledge and basic understanding of theoretical concepts;	a) a basic use of analytical methods to solve straightforward, familiar problems;
b) use of basic technical terms;	b) limited skill in justifying or considering alternatives;
c) a basic knowledge of ICT applications and their effects;	c) basic skills in using generic applications software;
d) a basic knowledge of administration of ICT systems;	d) the ability to test solutions in a limited way;
e) a knowledge of some common applications and standard applications;	e) the ability to produce basic documentation;
f) a knowledge of communications technology and some of its applications;	f) basic skills of evaluation;
g) a basic understanding of human–computer interfaces;	g) a basic use of ICT systems development tools to solve straightforward problems;
h) a basic knowledge of data types, objects, relational databases, files and other ICT structures;	h) the ability to select appropriate hardware and software for a particular situation.
i) a basic knowledge of common application generators;	
j) a basic knowledge of systems software;	
k) a basic knowledge of the characteristics of a range of hardware.	
The candidate has expressed simple ideas clearly, but may express complex and subtle concepts ineffectively. Arguments may be obscurely presented. Errors in grammar, punctuation and spelling may be present.	

AS ICT grade E

In general terms, candidates' work exhibited many of the performance criteria expected. The reviewers noted that coursework tended to lack evidence of at this grade boundary, and that candidates' ability to select appropriate hardware and software for a particular situation was often limited by the availability of hardware and software in school. As at grade A, candidates were unable to demonstrate a basic knowledge of common application generators, as this was not tested in the question papers.

Standards of performance across awarding bodies in computing and ICT at AS grade E

Standards of performance were broadly comparable across awarding bodies, although WJEC candidates tended to demonstrate a slightly lower standard. The reviewers commented that a high proportion of short-answer questions on the WJEC paper meant that candidates had limited opportunities to show their knowledge and understanding. Their coursework and their use of technical language also tended to be weaker.

Standards of performance at A level computing grade A

Table 6: A level computing grade A performance descriptions

Assessment Objective 1	Assessment Objective 2
In addition to the characteristics described for AS performance within Assessment Objective 1, candidates characteristically:	In addition to the characteristics described for AS performance within Assessment Objective 2, candidates characteristically:
a) demonstrate a good understanding of the main principles of systems analysis and design, methods of problem formulation, methods of planning solutions and systematic methods of implementation, testing and documentation. They have a good understanding of the need for critical thinking skills and the skills of project management. They see relationships between different aspects of the subject and are able to see computing in a broader perspective;	a) demonstrate the ability to apply their understanding of the main principles of systems analysis and design, methods of problem formulation, methods of planning solutions and systematic methods of implementation, testing and documentation. They are able to apply critical thinking skills and the skills of project management and teamwork to their system development;
b) in a wide range of contexts demonstrate knowledge and understanding of:	b) in a variety of application areas, demonstrate a well-developed ability to:
i. hardware, communications and a range of	i. derive the user and information

software and user interfaces;	requirements of a computer based solution;
ii. the characteristics of information and data types/structures;	ii. analyse and justify the need for and appropriateness of a computer-based solution to a problem;
iii. the methods of finding and using information to facilitate its effective use;	iii. specify and document the algorithm and data types/data structures of the solution;
iv. the systems development life cycle and the impact of computers on society;	iv. specify and document using appropriate systematic methods, the method of solving the problem including, where appropriate, evaluation of alternative proposals;
v. the systematic approach to problem-solving and software development methodologies;	v. select appropriate hardware and software and techniques for their use in solving a given problem;
vi. the characteristics of networks and importance of adopting standards;	vi. document the selection of appropriate hardware and software, and the method of testing the solution;
vii. the need for and characteristics of a variety of programming paradigms.	vii. successfully implement the solution to a problem;
	viii. carry out and evaluate testing;
	ix. develop technical and user documentation;
	x. evaluate methods and solutions on the basis of effectiveness, usability and maintainability.

A level computing grade A

As with AS computing, the reviewers judged that, in general, candidates demonstrated a good knowledge and understanding of the assessment objectives, and candidate work matched the performance descriptions. Nevertheless, there tended to be considerable evidence of knowledge and skills rather than of understanding in much of the work sampled. In addition, the assessment of coursework often meant that candidates who had followed non-standard routes were not fully rewarded for the design skills they had shown.

Standards of performance at A level ICT grade A

Table 7: A level ICT grade A performance descriptions

Assessment Objective 1 In addition to the characteristics described for AS performance within Assessment Objective 1, candidates characteristically demonstrate:	Assessment Objective 2 In addition to the characteristics described for AS performance within Assessment Objective 2, candidates characteristically demonstrate:
a) a thorough understanding of the principles of information systems and the associated theoretical concepts;	a) effective and appropriate use of a range of software;
b) a good understanding of the management of ICT systems;	b) an ability to design and produce high-quality, efficient solutions to complex problems using current systems development tools;
c) an appropriate and accurate use of technical language;	c) methodical, analytical and critical approaches to problem-solving;
d) a detailed knowledge of a range of applications packages;	d) the ability to design, operate and justify appropriate testing strategies;
e) a thorough understanding of the role of ICT in society and its effects on individuals and organisations;	e) clear communication of design decisions and solutions to problems;
f) informed opinions on the effects of ICT on society and on individuals and organisations;	f) effective skills of evaluation;
g) the application of knowledge and understanding to unfamiliar problems;	g) an ability to design suitable user interfaces for a range of situations;
h) a good understanding of data types, objects, relational databases and structures and how these are used;	h) effective communication skills.
i) a good understanding of organisation, audit and legal requirements;	
j) a good knowledge of common application generators;	
k) a detailed knowledge of systems software;	
l) a good understanding of human-computer interfaces/interaction.	

The candidate has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another smoothly and logically. Arguments will be consistently well structured. There will be few, if any, errors of grammar, punctuation and spelling.

A level ICT grade A

The work sampled exhibited many of the qualities expected in the performance criteria. As at the AS grade A boundary, in their coursework candidates were able to solve the problem successfully by designing and building a database. They tended to demonstrate effective and appropriate use of a single piece of software, rather than of a range (except for the use of a word-processor for the write-up). The reviewers noted that question papers did not require candidates to demonstrate informed opinions on the effects of ICT on society, individuals and organisations, and so there was limited evidence of performance in this area. As at AS, this was also true of candidates' knowledge of common application generators. Knowledge of systems software was tested, but not in depth, as questions on this area were mostly short-answer. Candidates tended to demonstrate basic – rather than detailed – knowledge of systems software.

Standards of performance across awarding bodies in computing and ICT at A level grade A

Standards of performance were comparable across awarding bodies – with the exception of Edexcel, whose candidates were judged to be weaker. They were more limited in the range and depth of their knowledge, understanding and skills, particularly in the examination papers. The reviewers commented that the structure of the Edexcel question papers made it difficult for candidates to show their knowledge, understanding and skills to best effect, particularly in section B.

Standards of performance at A level computing grade E

Table 8: A level computing grade E performance descriptions

Assessment Objective 1	Assessment Objective 2
In addition to the characteristics described for AS performance within Assessment Objective 1, candidates characteristically:	In addition to the characteristics described for AS performance within Assessment Objective 2, candidates characteristically:
a) show a basic understanding of the main principles of systems analysis and design and of systematic methods of implementation, testing and documentation.	a) demonstrate some basic skills of applying the main principles of systems analysis and design, and of critical thinking and project management;

They also show an awareness of the need for critical thinking and project management;	
b) in familiar contexts demonstrate an enhanced awareness of:	b) within familiar application areas demonstrate an ability to:
i. hardware, communications and commonly-used software and user interfaces;	i. derive some of the user and information requirements of a given problem;
ii. basic data types and the need to organise data for given purposes;	ii. specify and document methods of solution and data structures;
iii. the stages of systems development and problem-solving;	iii. select appropriate hardware and software and techniques for their use in solving a problem;
iv. the impact of computers on society;	iv. carry out testing;
v. the need for rudimentary maintenance of a system.	v. implement a solution to a problem.

A level computing grade E

The work sampled met the performance descriptions. The reviewers commented that most coursework projects tended to be of a fairly standard and traditional nature.

Standards of performance at A level ICT grade E

Table 9: A level ICT grade E performance descriptions

Assessment Objective 1	Assessment Objective 2
In addition to the characteristics described for AS performance within Assessment Objective 1, candidates characteristically demonstrate:	In addition to the characteristics described for AS performance within Assessment Objective 2, candidates characteristically demonstrate:
a) a relevant knowledge and basic understanding of theoretical concepts;	a) a basic use of analytical methods to solve problems;
b) an appropriate use of basic technical terms;	b) basic skill in justifying or considering alternatives;
c) a basic knowledge of ICT applications and their effects on society, individuals and organisations;	c) skills in using generic applications software;
d) a basic knowledge of management of ICT systems;	d) the ability to test solutions in a limited way;
e) a knowledge of common applications	e) the ability to produce basic

software;	documentation;
f) a knowledge of communications technology and some of its applications;	f) basic skills of evaluation;
g) a basic understanding of human–computer interfaces;	g) a basic use of ICT systems development tools to solve problems;
h) recognition of hardware and software required for a particular application;	h) appropriate communication skills.
i) a knowledge of data types, objects, relational database, files and other ICT structures;	
j) a basic knowledge of common application generators;	
k) a basic knowledge of systems software.	
The candidate has expressed simple ideas clearly, but may express complex and subtle concepts ineffectively. Arguments may be obscurely presented. Errors of grammar, punctuation and spelling may be present.	

A level ICT grade E

Overall, candidates' work met most of the performance descriptions. In coursework candidates rarely made any significant effort to justify the choice of hardware and software used, and there was little evidence of consideration of alternatives. As at all other grade boundaries, candidates were unable to demonstrate a basic knowledge of common application generators, as this was not tested. The reviewers found that candidates demonstrated significant awareness of the issue of communication via networks (under AO1f), as required in the syllabuses and question papers, but that this is not sufficiently reflected in the performance description.

Standards of performance across awarding bodies in computing and ICT at A level grade E

Standards of performance across CCEA, WJEC and OCR were comparable. AQA candidates demonstrated a slightly higher standard, while Edexcel candidates were judged to be the weakest.

AQA candidates were able to demonstrate their knowledge, understanding and skills consistently across papers, with good use of technical language.

Coursework was not included for the Edexcel candidates sampled, so the reviewers made their judgements solely on the evidence of performance in the examination components. The reviewers commented that candidates tended to gain low marks on many questions throughout the paper. They demonstrated limited breadth and depth of knowledge and understanding across the whole range of topic areas, as well as a lower level of computing skills.

Standards of performance over time

A level grade A

Standards of performance at grade A were maintained between 1998 and 2004.

A level grade E

Standards of performance were maintained for AQA and WJEC candidates. However, performance by Edexcel candidates was judged to have declined quite markedly. The lack of coursework from the 2004 candidates made it hard for the reviewers to make confident judgements, but it was noted that the 1998 and 2004 question papers both contained a very similar question on holiday rentals, with similar mark allocations. The reviewers were unanimous in their view that candidates performed better on this question in 1998. The relatively poor performance of Edexcel candidates over time at this grade boundary is in line with the judgements made across awarding bodies in 2004.

5. Findings about performance descriptions

In the course of their evaluation of candidates' performance against the published performance descriptions, the reviewers identified a number of shortcomings in the descriptions themselves. Some of these shortcomings were very specific, while others were more general, but they were mainly related to the way coursework was reflected in the descriptions. Some of the reviewers' comments also had implications for the future development of subject criteria and of new syllabuses. The reviewers noted that:

- There appeared to be no rationale for the inclusion of comments about the quality of written communication in the performance descriptions for ICT, but not in those for computing.
- The inclusion of a reference to common application generators in each of the performance descriptions for ICT was judged not to be warranted. (Significantly, this aspect was not tested in any of the examinations reviewed.)
- Neither the performance descriptions nor the syllabuses attached enough weight to information security management and information strategy. The descriptions, which covered security under ICT management, particularly need to be defined in more detail.
- Neither the performance descriptions nor the assessment criteria gave enough weight to how successful implementation was in coursework. As a result, even some of the high-scoring projects did not match the needs of the user – and it was doubtful that they would actually work. In the case of borderline grade E candidates, implementation was often the main strength of their coursework.
- The reviewers noted that it might have been easier to make judgements about implementation in candidates' work, had projects been available in electronic form. The reviewers found that they often had to make judgements about extraneous elements of candidates' projects rather than about the IT element itself.
- The coursework expectations implied by the performance descriptions and reflected in the assessment criteria did not adequately reflect current trends, technology and industry standards. In particular, candidates were encouraged to attempt safe and traditional types of problems – such as a video store database. This could penalise candidates attempting more innovative work – for example web-based projects; large, team-based projects; or graphical, multi-media or animation-driven projects.
- In ICT coursework, at both the AS and A level grade A boundary, it was expected that candidates should demonstrate 'effective and appropriate use of a range of software'. Only OCR candidates (who had to complete structured tasks at AS) met

this aspect of the performance description. However the reviewers agreed that, even at A2, highly successful and appropriately-rewarded projects would often fail to meet the performance description. For example, a project might involve designing and building a database – and thus require only one software package (supplemented by the use of a word-processor).

6. Summary of findings from review of performance

Overall, candidates' work exhibited many of the qualities required by the performance descriptions, for both grade boundaries and at both AS and A levels (subject to the exceptions mentioned previously). There was agreement among the reviewers that the descriptions were appropriate for written papers in terms of the level of demand, but that in some cases they required updating.

It was also judged that the assessment criteria and performance descriptions relating to coursework gave more credit to candidates for what they could write about rather than for what they could do.

Standards were broadly comparable across the awarding bodies at AS level – except in the case of WJEC, whose candidates were judged to be slightly weaker at grade E.

At A level, Edexcel candidates demonstrated a lower standard of performance at both grade boundaries than candidates from other awarding bodies, while AQA candidates performed slightly better at grade A.

Over time, standards of performance had been maintained at grade A. The reviewers judged that overall standards had been maintained at grade E as well, but they found evidence of a decline in the standard achieved by Edexcel candidates on the examination papers between 1998 and 2004. This was consistent with the findings across awarding bodies in 2004.

Appendix A. A level syllabuses reviewed

Year	Awarding body and syllabus				
	AQA	CCEA	Edexcel	OCR	WJEC
1998	Computing 0643		Computing 9105		Computing 007099
2004	ICT 6521	ICT 2650	Computing 9106	ICT 7838	Computing 034090

Appendix B. A level scripts reviewed

Numbers of A level scripts reviewed at Grades A and E

Awarding body	AQA		CCEA		Edexcel		OCR		WJEC	
	1998	2004	1998	2004	1998	2004	1998	2004	1998	2004
AS		A: 8		A: 8		A: 8		A: 8		A: 8
		E: 8		E: 4		E: 4		E: 4		E: 8
A level	A: 8	A: 8		A: 4		A: 4		E: 4	A: 4	A: 8
	E: 8	E: 8		E: 4		E: 4			E: 4	E: 8

Appendix C. List of reviewers

Review team	
Coordinator	Peter Woods
Syllabus reviewers	Judith Briers Diane Spencer Sonia Stuart
Script reviewers	Susan Burn Gerard Lynch (CCEA) Monica Mason (Edexcel) Ian Paget (OCR) Jacqueline Rogers Richard Rothwell Paul Spedding (WJEC) Helen Williams (AQA)

Note: where participants were nominated by a particular organisation, the awarding body is shown in brackets after their name.