

# ***Advancing Physics* evaluated**

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## **Abstract**

The first phase of an evaluation of the new AS/A-level course *Advancing Physics* sponsored by the Institute of Physics, is now complete. It shows that the course has achieved very high satisfaction ratings from teachers of the course, and that a majority of these teachers see it as achieving its main aims. In the interests of further improving the course and winning it even wider acceptance, the first phase of the evaluation was designed to pin-point aspects of *Advancing Physics* that offer scope for improvement. Two such aspects have been identified: Course planning and use of the CDs, and arrangements for coursework in the examination.

## **The evaluation plan**

The Institute of Physics set up an Evaluation Group, chaired by Professor Mick Brown, to plan and implement a phased evaluation of *Advancing Physics*. The Institute of Physics, the publisher, OCR, the project team and teachers of the course are represented on the committee, together with independent consultants. The aim of the first phase, now complete, was:

- to obtain evidence about whether *Advancing Physics* is worth further support and, if so
- to identify areas where there may be scope for improvement

The aim of phase 2, already set in motion, will be to investigate in greater depth the areas of potential improvement identified in phase 1, with a view to recommending future action to improve the course and its infrastructure. In addition, data on examination entries and success rates, available nationally, are being collected.

In phase 1, a School/College Questionnaire was sent in April 2002 to all Centres that have purchased *Advancing Physics* materials. In addition, each Centre was sent several copies of a second questionnaire, addressed to individual teachers of the course, seeking their personal opinions. 138 Schools or Colleges using the *Advancing Physics* course responded. They contained 380 teachers teaching *Advancing Physics*, 218 of whom responded to the Teacher questionnaire. These centres are broadly a statistically fair sample of those adopting *Advancing Physics*.

Data on sales of materials and examination entries and success rates are in an Annexe.

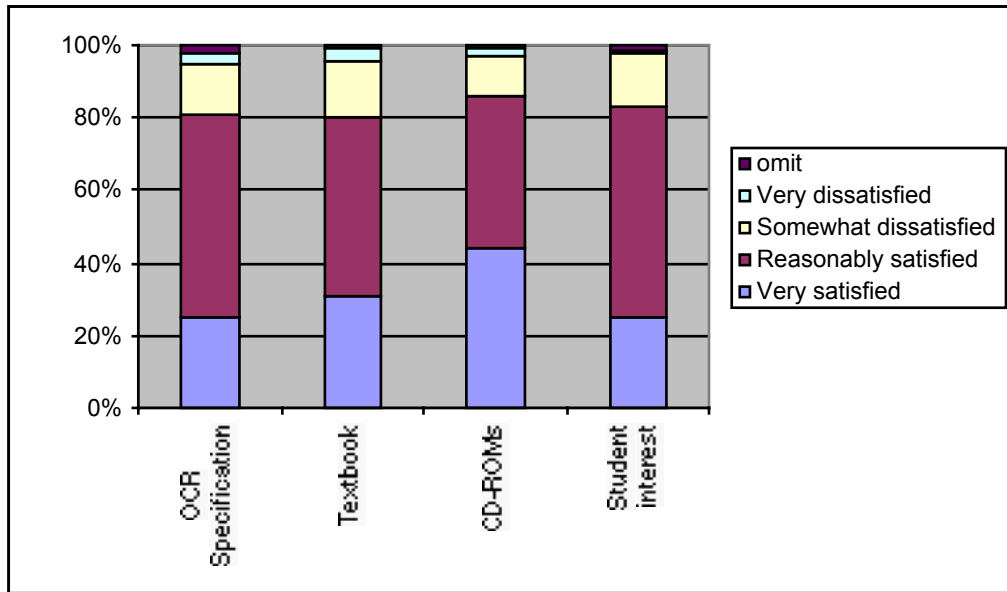
## **Satisfaction with *Advancing Physics* materials and support**

The individual teacher questionnaire asked teachers to indicate their satisfaction or dissatisfaction with various aspects of the *Advancing Physics* course, materials and infra-structure. In all cases the responses were more positive than negative, often much more so.

## **Specification, course materials and student interest**

Satisfaction with the specification, course materials and student interest is very high, with over 80% being very or reasonably satisfied. On this measure the CD-ROMs come out very well indeed, with the highest proportion very satisfied with them.

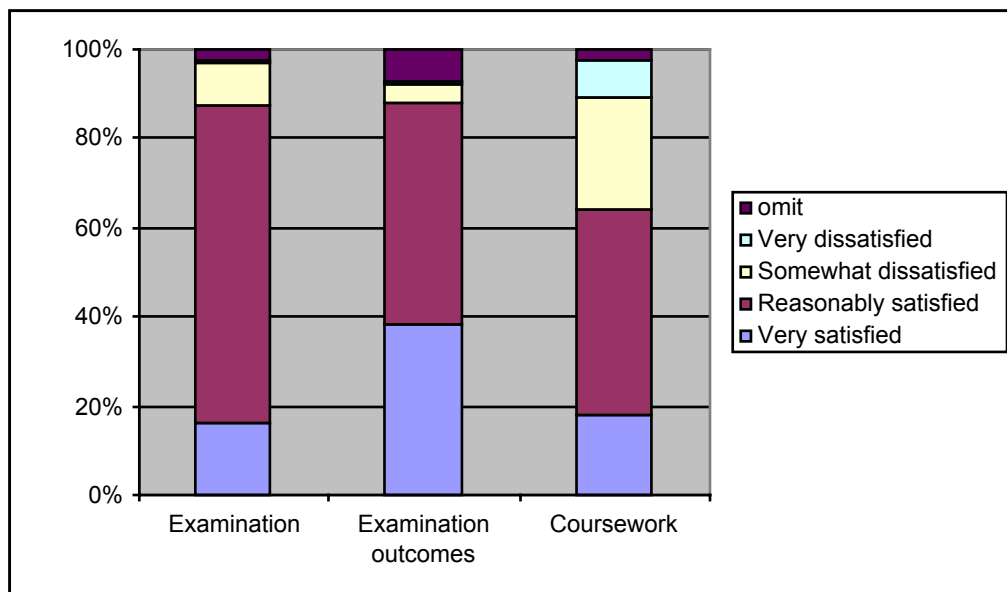
However, they do attract a substantial body of detailed critical comment in a later part of the questionnaire (see below).



**Figure 1** Satisfaction with course materials

The teachers tend to be reasonably, rather than very, satisfied with student interest and the OCR specification. However, the picture here is overwhelmingly positive, especially in view of the novel nature of the textbook and CD-ROM package. Very few omitted to answer.

## Examination



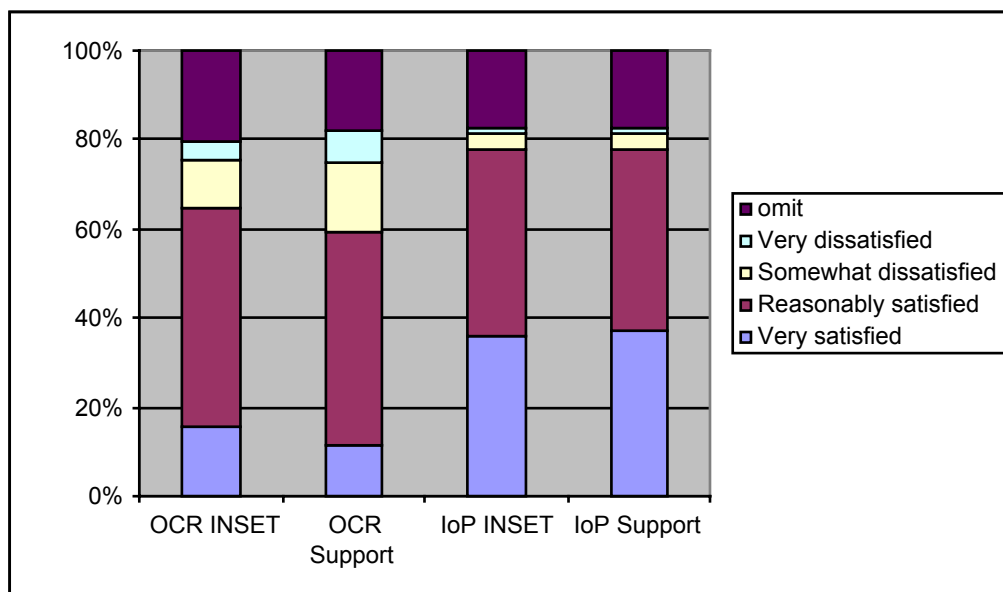
*Figure 2 Satisfaction with examination*

Satisfaction with the examination and its outcomes is very high, with about 90% of responses being positive. The coursework element of the examination, whilst viewed positively by a majority (66%) is regarded as not fully satisfactory by a substantial minority. Again, this is reflected in written comments, discussed below.

### **OCR and IoP INSET and support**

Satisfaction with the INSET and support provided by the Institute of Physics is very high indeed amongst those who responded. Satisfaction with OCR INSET is also high, but satisfaction with OCR support is lower, though still strongly positive.

However, it must be significant that about 20% of teachers omitted to give a response. This could be because an important minority of the teachers responding had not experienced INSET or support.



**Figure 3** Satisfaction with INSET and support

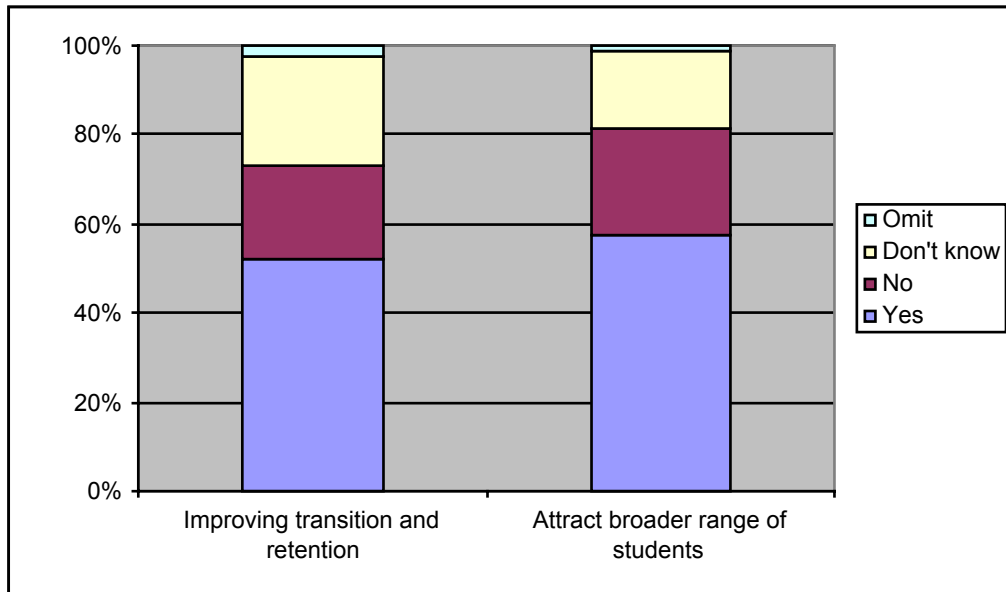
### Overall approval of Advancing Physics

Teachers were asked whether, if the choice were theirs alone, they would want to continue with *Advancing Physics*. 85% said they would.

### Improving transition and retention, and broadening access

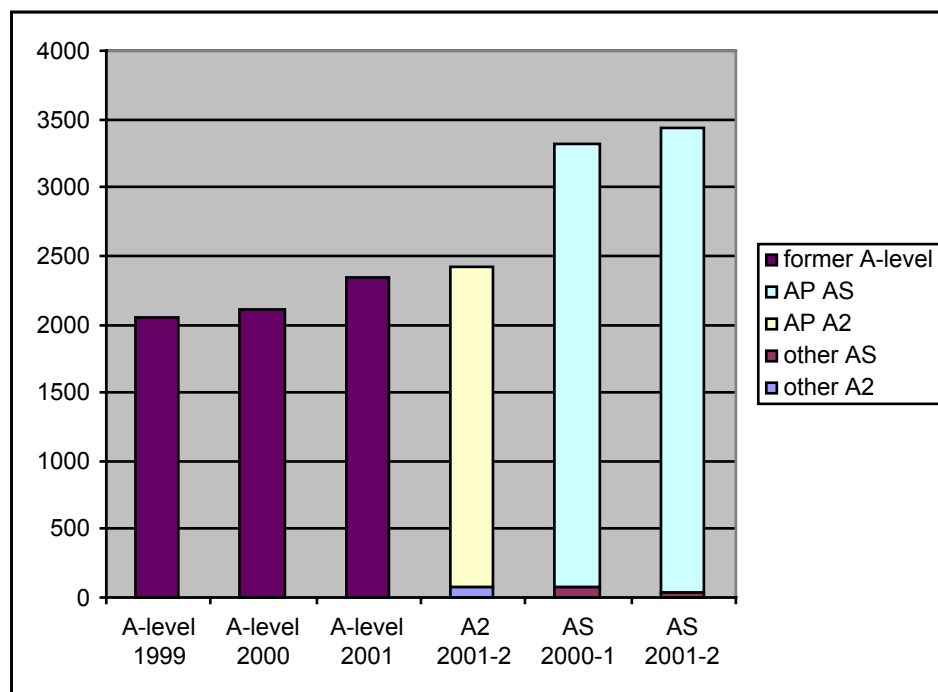
One aim of *Advancing Physics* was to ease the transition from GCSE to A-level, and to reduce the number of students who get into difficulties and so to improve retention rates. Another aim was to attract, and be accessible to, a broader range of types of student. The School/College questionnaire asked the head of department to give an opinion on whether these aims are being achieved.

Just over half of the heads of department saw signs that the aim of easing transition from GCSE and improving retention was being achieved. Slightly more saw signs of achieving the aim of broadening the appeal of A-level physics. A substantial number of "don't know" responses was anticipated, because it is early days, trends may well not be clear, and the judgement is in part subjective. However, in the event only about a fifth to a quarter of respondents felt unable to give a view.



**Figure 4** *Transition and broadening*

### Numbers taking Advancing Physics, and gender ratio



**Figure 5** *Numbers taking A-level, AS and A2*

Another sign that the aims of *Advancing Physics* are being achieved would be increased numbers taking AS and A2 Physics, as compared with previous years. The School/College questionnaire sought information on this point, asking for numbers studying AS *Advancing Physics* in 2000-1 and in 2001-2, and numbers continuing to A2 *Advancing Physics* in 2001-2. For comparison we asked for numbers who had taken A-level Physics, prior to the introduction of the AS/A2 system, in the three two-year periods ending in 1999, 2000 and 2001.

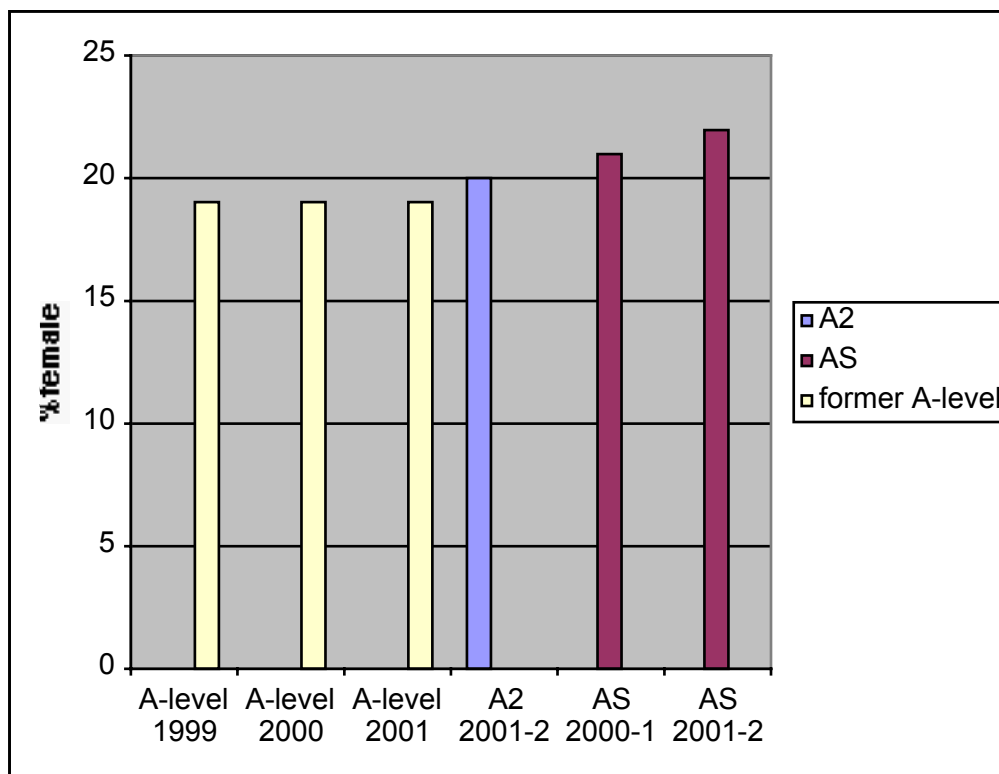
In these schools, about 3300 students took *Advancing Physics* AS in 2000-1 and 2001-2 (two of the centres began *Advancing Physics* only in 2001-2 and two centres ran *Advancing Physics* in parallel with other AS and A2 specifications, accounting for the small numbers of students shown taking other specifications). This number compares favourably with the numbers taking A-level physics in previous years, which was about 2100 in the years 1999 and 2000, rising by about 10% to 2300 in 2001. Thus total AS participation was up by 55% on the average of the previous three years A-level participation, and up by 43% on the highest and most recent year.

Simply on the basis of a shift from three subjects to about four at AS in the new system, one might expect a 33% increase, if physics lost or gained no "market share" (the fear was always that it would lose). The evidence here is of some gain.

The individual school/college results suggest that there are some substantial specific school effects at work. Certain centres experienced very substantial increases in numbers (the largest was 300%); others little or none. This suggests further study of differences between "very successful" and "less successful" centres.

In the centres responding, about 70% of students taking *Advancing Physics* AS continued to A2. Numbers taking *Advancing Physics* A2 are up by about 11% on the average of the previous three years, but only by 3% on the best and most recent year.

Gender balance is hard to shift. *Advancing Physics* may have made things slightly better, with 19% females in previous A-levels, rising to about 21% for *Advancing Physics*.



**Figure 6** Percentage of female students

Overall, then, the message – to be checked against national data – seems to be that *Advancing Physics* is succeeding in its aim to increase the numbers of students experiencing some physics at this level, and to encourage the participation of girls.

### **Does *Advancing Physics* deserve continuing support?**

The generally positive evidence from this part of the evaluation suggests that *Advancing Physics* has had sufficient initial success to make it well worth further support, with an aim to improve the course, its materials and its support systems in critical areas.

### **What areas for improvement are indicated?**

The questionnaire to teachers included several free response questions:

- For you, what are the two most **positive** aspects of *Advancing Physics*?
- For you, what are the two most **negative** aspects of *Advancing Physics*?
- What is your own personal appraisal of the successes and failures of *Advancing Physics*, as you experienced them?
- Please suggest any areas in which you see room for further improvement in *Advancing Physics*.

As expected, these questions gave teachers a variety of opportunities to identify strengths and weaknesses of *Advancing Physics*.

### **Positive aspects**

The main positive aspects to emerge are:

- **Course content:** novel, modern, up-to-date, fresh, fun, challenging, interesting to students, relevant with useful applications, enjoyed exploring new areas of physics
- **Text:** new, fresh, interesting, graphic, well tailored to course, clear structure and layout, relates theory to everyday applications
- **CD-ROM and resources:** good quantity and variety of resources; plenty of ready prepared material including questions; good use of ICT, delivering good teaching aids
- **Appeal to students:** interesting and stimulating; AS offers an attractive choice for students wanting some science at A-level; students like independence and choice they get
- **Coursework:** students get a lot out of coursework; coursework varied and of benefit; key communication skills developed
- **Examination:** straightforward, good pass rates, good marks for average and above average, student-friendly, good for weak students too; good novel aspects.
- **Teaching:** encourages variety of teaching styles; allows different ways of teaching; course is flexible and adaptable; interesting to teach; course structure varied and well-ordered; Invested a lot of work in the course and now its considerable merits of being innovative, relevant and interesting for pupils are becoming clear.
- **Support:** good support from IoP, OCR, and email network; regional groups helpful and productive.

It is important to remember that there is normally a “halo” effect with any successful innovation, with initial adopters being very positive in their attitudes.

### **Possible areas for improvement**

Two concerns emerge rather clearly:

- The clarity and definiteness of the course, and the time and effort needed to plan it. This is linked to problems of using materials and advice on CD-ROMs.
- Amount and complexity of coursework and the difficulties of marking it

#### **Clarity and definiteness of course: time and effort needed to plan course**

By design, *Advancing Physics* provides teachers with a wide range of choice of resources and approaches. It offers a flexible and adaptable range of resources, intended to cover the needs of a wide variety of schools. The work of making these choices and of arriving at a course tailored for one's own circumstances is substantial. Several say how it is difficult to select from the wealth of material and pin down essentials.

For some teachers the underlying problem is the process of changing to a new course rather than the course itself. This is not only caused by the unfamiliarity of the structure of the course and the materials, etc. but also by other pressures that face teachers and take up their time. As one teacher said, 'First year involved a lot of planning but now it is set up, it is great.' A substantial number of teachers note how these difficulties diminish rapidly with time and experience.

At the centre of these concerns is the nature and structure of the CD-ROMs for teachers and students. There is a substantial quantity of detailed critical comment on them:

- Too big to be a useful resource; navigating the CD is difficult; coding of resources is confusing. OCR Specification, book and CD need to be brought into line.

By their nature, CD-ROMs are a new medium with unknown possibilities and problems. But they also got very high satisfaction ratings indeed. We need to investigate further the nature of the problems of resource selection, and course planning, with particular reference to the structure and content of the CD-ROMs. We need to clarify which of the following issues are the crucial ones:

- Is it a course-management problem, not a technical information-store problem? If so, what would be needed to help teachers manage the course better, and have less trouble in selecting resources?
- Is it a "CD problem"? That is, does the nature of a CD (not easy to flip through, though easy to search) mean that teachers are uneasy about not having looked at what they need to look at?
- Is it a "new course anxiety problem"? That is, are teachers worrying because in a new situation they simply cannot know from experience what to do?
- Is the issue one of not quite knowing what to tell students to revise, or students wanting some pre-packaged revision guide?

#### **Coursework and course load**

There is a substantial body of comment on the coursework load for teachers and students. Some consider three pieces of coursework at AS to be too much. Some teachers find the work of coursework assessment burdensome and worrying. The

linkage of coursework and assessment modules at A2 is criticised (this was forced on the development team by the exigencies of QCA rules).

It is clear from the weight of comment and the responses reported previously, that coursework, especially at AS, is a real issue, where there is scope for improvement. But it needs further work to find out the real nature of the problem, considering:

- The actual amount of student work and time required, which was designed to be modest, and the possible impact of coursework in other subjects
- The impact of students' and teachers anxieties about coursework in "high stakes" examining, which may lead to time-consuming practices (e.g. returning coursework to students with notes indicating areas to improve to get better marks).
- The complexity of the job of assessment (in part driven by mark allocations and schemes), its appropriateness in view of the modesty of the intended demand, and whether it could be simplified.
- The different impacts of coursework and its assessment in large and small centres. In small centres, judgement may be difficult. In large centres, administration and comparability may become time-consuming.

Taking action for improvement in respect of coursework is not simple, because it involves changing the specification, which must be done by OCR with QCA approval. And it should be remembered that coursework is a potential source of independence and involvement of students, which teachers value.

## Conclusions

*Advancing Physics* has been very well received, and there is evidence that it can make physics more accessible to a wider range of kinds of students. There are indications that it can increase total numbers, and can have some favourable impact on the participation of girls.

It is clear that the course deserves continuing support, particularly through INSET and regional meetings for teachers. IoP supported INSET has been very successful.

Two areas emerge to be investigated in Phase 2, with a view to identifying possible improvements:

- **Course planning and selection of resources:** the clarity and definiteness of course; the time and effort needed to plan course and select resources; the quality and nature of the CDs. How can it be made easier for teachers to find their way through the materials? Can the CD structure and content be improved to help? What might be the role of INSET and advice?
- **Coursework and course load:** Can the existing coursework be made to seem less onerous to teachers and students? Are there feasible alternatives (both nature of course work and form of assessment)? How would alternatives be regarded? In parallel, is the overall course load too heavy, especially at AS?

Work on these two areas has begun, by a group chaired by Philip Britton. Teachers who would like to contribute to this work are invited to email the project administrator Ingrid Walker ([Ingrid.Walker@iop.org](mailto:Ingrid.Walker@iop.org)).

## **Acknowledgments**

Thanks are due to Dr Bob Fairbrother for undertaking the coding and first analysis of the questionnaire data. We thank Professor Hazel Francis for her professional advice in the design of the evaluation, and for her help in establishing and checking coding schemes.

## Annexe: Examination and sales data

Copies of the Advancing Physics materials sold to date (August 2002) are:

AS Student text	17748
AS Student network CD-ROM	4835*
AS Student single user CD-ROM	10330
AS Teacher single user CD-ROM	1677
AS Teacher network CD-ROM	100
A2 Student text	11066
A2 Student network CD-ROM	320*
A2 Student single user CD-ROM	7020
A2 Teacher single user CD-ROM	1299
A2 Teacher network CD-ROM	98

\*For AS Student network CD-ROM the figure given is CD's sold, plus users licensed. For A2 the corresponding figure is just CDs sold.

The new AS/A2 system was introduced in September 2000, with the first candidates completing the AS course in Summer 2001 and the A2 course in Summer 2002.

Numbers of candidates entering for the AS and A2 qualifications, with percentages passing, and obtaining grade A, are shown below.

### Summer 2001 AS

<i>Awarding body</i>	<i>Entry</i>	<i>% pass</i>	<i>% grade A</i>
<b>OCR (B) Advancing Physics</b>	<b>6322</b>	<b>93.2</b>	<b>24.9</b>
OCR (A)	6059	86.1	19.7
<b>Edexcel (B) Salters Horners Physics</b>	<b>2267</b>	<b>83.9</b>	<b>19.8</b>
Edexcel (A)	6226	84.7	25.9
AQA (A)	6556	85.3	24.9
AQA (B)	3321	82.1	21.2
<b>TOTAL</b>	<b>30801</b>		

### January 2002 AS

<i>Awarding body</i>	<i>Entry</i>	<i>% pass</i>	<i>% grade A</i>
<b>OCR (B) Advancing Physics</b>	<b>411</b>	<b>92.9</b>	<b>20.4</b>
OCR (A)	476	94.2	17.4
<b>Edexcel (B) Salters Horners Physics</b>	<b>130</b>	<b>94.6</b>	<b>10.8</b>
Edexcel (A)	721	91.5	25.0
AQA (A)	423	92.0	22.5
AQA (B)	247	89.5	23.9
<b>TOTAL</b>	<b>2408</b>		

### Summer 2002 AS

<i>Awarding body</i>	<i>Entry</i>	<i>% pass</i>	<i>% grade A</i>
<b>OCR (B) Advancing Physics</b>	<b>7317</b>	<b>90.1</b>	<b>24.7</b>
OCR (A)	7099	84.1	20.0
<b>Edexcel (B) Salters Horners Physics</b>	<b>2952</b>	<b>82.8</b>	<b>20.5</b>
Edexcel (A)	8170	83.5	25.1
AQA (A)	7389	84.0	24.0
AQA (B)	3593	80.6	19.7

<i>TOTAL</i>	36520		
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**Summer 2002 A2**

<i>Awarding body</i>	<i>Entry</i>	<i>% pass</i>	<i>% grade A</i>
<b>OCR (B) Advancing Physics</b>	<b>5891</b>	<b>96.6</b>	<b>29.1</b>
OCR (A)	6136	93.8	23.7
<b>Edexcel (B) Salters Horners Physics</b>	<b>2015</b>	<b>90.3</b>	<b>22.5</b>
Edexcel (A)	7186	91.1	27.2
AQA (A)	5882	94.8	28.2
AQA (B)	2813	91.7	24.4
<i>TOTAL</i>	29923		